Canadian Government Surveys.

I.

Written for ENGINEERING NEWS.

BY D. L. S.

In the preliminary training which a student of land surveying has to undergo, one very important branch of a surveyor's education, on his proficiency in which depends very much his future success, is generally left out. We refer to the art of "wire-pulling." How important a study this is will soon appear.

The Dominion Government and the Governments of the separate Provinces set apart each year a sum of money to be expended on surveys.

In the case of the Dominion Government this amount varies greatly. For instance, in 1876, thirteen surveyors got work; in 1877, seventeen; in 1878, twenty; in 1879, thirty-two; in 1880, fifty-one; in 1881, seventy-four; in 1882, ninety-two; in 1883, 119; in 1884, sixty-nine; in 1885, fourteen. The decrease since 1883, (especially in 1885) was partly due to the trouble with the Metis and Indians in the latter year, and partly, no doubt, to the lavish expenditure in 1882 and 1883.

On an average then in the last ten years, there have been fifty surveyors each year who have procured employment from the Dominion Government.

The Provinces are much less erratic in their disbursements for surveys.

Ontario, for example, during the last ten years has sent out from fifteen to twenty-five surveyors, giving employment on an average to about twenty, and spending approximately $40,000 per annum.

In the whole Dominion there are, let us say, 400 Dominion land surveyors, all, or nearly all, of whom cannot make use of their commissions except by procuring work directly from Government.

In Ontario there are about 300 Provincial land surveyors, 100 of whom could doubtless do all the local work, surveying city and village lots, farm lots, etc., and still not become millionaires.

Such being the case there are necessarily a great number of both Dominion land surveyors and Provincial land surveyors who are "out of a job" and who, thinking it the best chance of getting into one, strive among themselves to see who shall make up the small number chosen by the Government.

Out of the chosen ones there are a certain number, say one-half, who are sure to get work if they apply for it, and if there is any to be done. These are the principal lights in the profession and the old and tried servants of the Government, who, having served faithfully in the past, and having perhaps neglected, or given up, their local practice for the sake of Government work, are justly entitled to some consideration.

The other half is made up from among the less noted and younger members of the profession, and out of these, the lucky ones are those who can bring the greatest influence (especially political influence) to bear on the Department of Interior or Crown Lands Department.

Now we see the good of being master of the art of wire-pulling.

To make the most successful kind of "wire-puller" a man should have two faculties in particular strongly developed—persistence and "cheek". Let the surveyor who has a plentiful supply of these set to work properly—let him button-hole influential friends on all occasions, let him peg away at M. P's. and ply them with begging and promising letters till the M. P's. despairing ask the required favor of the Minister, and the chances are hard if the exhausted Minister does not grant it, provided the suitor be of the same political persuasion as the party in power.

"Γεωμετρης Αγωνιστης"

(From the Proceedings of Association of Dominion Surveyors.)

Of late years success in obtaining Dominion work has also apparently depended considerably on the nationality of the applicant, for since 1880 the number of French Canadians has swelled from about 6 per cent. to about 25 per cent. of those employed.

Let us now suppose that our surveyor, through his own merit or through successful "wire-pulling," has got his application for work accepted by Minister or Commissioner, as the case may be. On obtaining the contract he will be required to enter into a bond jointly with two securities for the due and faithful fulfillment of the said contract, the amount of the bond being sufficient to cover the estimated value of the contract.

It is our intention to take up separately the conduct of the work on modern Provincial and Dominion surveys. But before doing so we will give an idea of Provincial surveys 100 years ago, as gathered from the notes of an old Government surveyor for the Province of Ontario.

The following report made by Joseph Cauchon, Commissioner of Crown Lands, in 1857, on the old methods of survey, will be of use in explaining what follows:

"The settlement of lands in Canada under the tenure of free and common soccage commenced in the year 1783, when the United Empire Loyalists were located on the Bay of Chaleu s in Lower Canada, and on the banks of the St. Lawrence and its lakes in Upper Canada; the surveying establishments being on a very limited scale, they could not survey townships regularly, but could only lay out the front lots as they were required by the settlers. The concessions in the rear were afterward surveyed as occasion required or opportunity permitted.

"The townships were originally intended to be six miles square (as in the United States) and the lots 19 chains in front, by 63 chains 25 links in depth, containing 120 acres each, but by the royal instructions of the 23rd August, 1786, by Lord Dorchester, townships fronting on navigable rivers and lakes, were ordered to be laid out nine miles in front, by twelve miles in depth, and subdivided into twelve concessions or ranges of twenty-eight lots each. Inland townships were to be ten miles square, and subdivided into eleven concessions of twenty-eight lots each.

"Owing to the use of the magnetic needle and the inferiority of the surveying instrument used, and to the unskilfulness of some of the surveyors, who did not make allowance for the

difference in the variation of the compass at different places, nor to the progressive change in the variation at the same place, and especially owing to the want of check lines, many gross errors were made in the older surveys.

"In the year 1818, an attempt was made to ensure greater accuracy in the township surveys in Upper Canada, by instructing the surveyors to ascertain the latitude and the variation of the magnetic needle at certain points in the survey; but in consequence of the surveys of that period having been performed by contract, and paid for in land, the attempt was not successful, for of all the older surveys none have been found to be so irregular and defective as these.

"No system of check lines was introduced into Upper Canada surveys until the year 1829, when on the report of the late William Chewitt, then Surveyor General, an order in Council was passed, authorizing the drawing of lines across the concessions in the middle of the road allowances between every sixth lot. The sections, however, into which this mode of survey divided the townships were too large,

OFF FOR THE WOODS. 1819.

containing nearly four square miles each, subdivided into twelve lots, each 30 chains by 66⅔ chains, so they were subsequently reduced to 100 chains square, subdivided into ten lots, each 20 chains in breadth, by 50 chains in depth.

"Since the year 1818 the limits of the road allowances have been defined by a double row of posts. As all the outlines of every section are now surveyed in the middle of the road allowances, the uncertainty as to the true position of the roads, and the errors in the areas of the lots so frequent in the older surveys are avoided."

From the old Government accounts it seems that from 1763 to 1789 township surveys cost £2 5s. per lineal mile; from 1790 to 1822, £2 10s. to £3, from 1823 to 1836, £5 per 1,000 acres. The average cost per acre from 1802 to 1840 was 2d.

The surveyors were paid sometimes by the year, sometimes by the day, and sometimes in land by receiving about 4½ per cent. of what they surveyed.

Among the documents left by the old surveyor before referred to are instructions, field-notes, diaries and correspondence relating to the survey of the township of Lisbon (New York State) and of a number of townships and parts of townships in Ontario.

The following is taken from instructions issued for the survey of parts of what is now the County of Leeds, in 1809:

"Instructions to X. Y., Esqu., a licensed surveyor to survey and lay out certain concessions and parts of concessions in the townships of Augusta, Elizabethtown, Yonge, Lansdown and Leeds in the District of Johnstown, as have not been completed (Sic) in Survey.

Sir: In obedience to his Excellency the Lieutenant Governor's commands to us, bearing date the 11th, May, 1809, to complete the survey o. the following Townships, viz: Augusta, Elizabethtown, Yonge, Lansdown and Leeds.

You are hereby required and directed without loss of time to survey and lay out (here follows a list of concessions), "and whatever Magestral or Concession lines, as may not have been heretofore completed in survey in the afor said township.

For the execution of which, yourself and party will be allowed the same pay and ration as allowed upon the Survey of the Township of Pittsburgh, and your Vouchers, Journal, Field Book, and Plans must be returned in the same manner as directed on the Survey of the said Township—but considering that you will have to pass through a well settled Country, in general, your party is to consist of no more than two Chainbearers and six Axe men being Eight in all, as no more will be allowed—and a reasonable time will be allowed for the time of your Party and for purchasing provisions, which it is supposed may be done at one, and the same time.

You must be very particular in the entries and discharges of your Party so that your Journal and Pay List may correspond; and you must note particularly in your Field book the Lots and Concessions on which the White and Yellow Pine are to be found.

[Signed] CHEWELL & RIDOUT
Adj. Surveyor Gen'l."

The following letter will give an idea of the extensive pay of Surveyors at the beginning of this century:

SURVEYOR GENERAL'S OFFICE.
YORK, 10th Oct., 1815.

Sir: I was yesterday favoured with the receipt of your letter of the 15th September.

The return of Lt. Governor Gou to this Province has probably for a moment suspended the Execution of the orders of Sir Frederick Robinson.

The plans, therefore, which I had prepared of the Townships on the Rideau await the orders of His Excellency the Lt. Governor.

Immediately upon the Governor's arrival, I represented to him the comparative low price allowed in this Department.

Whereupon His Excellency has been pleased to direct that 10s. 6d. pr. day be the pay of the Deputy Surveyor, 3s. 9d. for the Chainbearers each per day, and 2s. 6d. for each axeman, with the usual allowance of 1s. 3d. for furnishing the necessary ration.

I am of opinion that a permanent Surveyor for the Eastern & Johnstown Districts would be advantageous to the service, especially if the settlement therein of Emigrants, &c., be continued. Upon this subject as circumstances may require, I will take an opportunity of speaking to His Excellency.

I am, sir, your most obedt., humble servant.

[Signed] T. RIDOUT,
Surv. Gen'l.

A moral which surveyors might do well to take to heart can be drawn from the following extract from a letter sent to the Surveyor General from Perth Settlement in 18 6.

After complaining of neglect, want of instruction, etc., from the Government, our surveyor winds up thus:

"As I find no permanent situation in your Department or Augmentations of pay is likely to be obtained for me, I beg leave to state that on the close of the present Survey I shall decline going in the woods any more, and will endeavor to find other means to support myself and family before my constitution is entirely ruined."

Probably the powers that be, had administered salve to our friend's injured mind, for on February 23, 1819, we find him starting off with five axemen and two chainbearers to survey in a township.

We append extracts from the entries in his diary:

"25 Feb. Gave the men 1 qt. of whiskey in the morn and gave them 1 qt. of spirits on the road up. Purchased 4 axes for 11 dollars."

"4 Mar. It snowed mostly all night and I could not get the stars in my horoscope."

"6 Mar. Rain and sleet all night and still raining accompanied with heavy thunder at times. The trees very much loaded, not possible to work. In the afternoon work my way out to Hopkins."

"Sunday, 7 Mar. Lying still all day, my face swollen very bad.

"8 Mar. I am laid up yet."

"9 Mar. With my chops bound up I go to the woods."

"Sunday 14 Mar. The boys go out and bring 3 packs of biscuit and all get drunk."

"Sunday 21 Mar. I go out in search of snowshoes and travel all night and next day breakfast at Ancaster."

"Mon. 22 Mar. Obtain 4 pairs and return by way of Dundas. Meet McLean and Gilchrist with a keg of whiskey. I sleep at Hopkins."

"23 Mar. I go out and find all my party squibby, having drank up my whiskey and their own and they had not moved the camp yet."

Here follow some d's and dashes, evidently intended to express our surveyor's feelings.

After a good deal of hard work in the end of March and beginning of April, an entry which most surveyors can appreciate occurs.

"8 Ap. Hudson almost gives out to-day with wading in snow and water and all the men pouting and grumbling."

Two days after they refuse to work any longer and leave him.

However in a couple of weeks he gets together a new party.

"22 Ap. Commence the new township. Mosquitoes bite some to-day."

"24 Ap. I send 3 men out for provisions."

"25 Ap. I go out with McCallum. Find the men asleep on the road."

"29 Ap. Hudson having broke out with the meazles. Send him out."

"30 Ap. Mosquitoes very plenty."

"14 May. Came out and all hands squibby nearly."

The diary of an assistant of our surveyor, kept during a survey made in 1810 is also interesting. He begins his tale of woe:

'Saturday 20 Jan. Clear day but intolerable cold. I have this day Frozen my Toes returning to camp from work it is so cold that the Ink in my pen freezes so that I cannot write before a great fire."

"22 Jan. Cloudy morning. Looks like for snow but so cold it cannot."

"Sunday 28 Jan. Clear and very cold all hands at different Employments some mending shoes and some mending clothes, etc.

"30 Jan. This afternoon my hand is lame so that I could not continue on the Line.

"13 Feb. Myself sick the party continue line."

"14 Feb. I return home."

"23 Feb. Removed the baggage to lot no. 31 and chained the same then continued Running the Cous line and Run about 2½ miles and Returned to Camp about Sunset and Closed the Day over a cup of good soup.

"24 Feb. Went to Mr. Weekwires to cut a glass for the compass."

"25 Feb. Being on Sunday and a very wet Rainey morning I Returned to camp found the Party all well no work Dun on the account of Rain so we closed the day In piece and harmony after mending, writing and shaving etc. etc."

"8 Mar. Clouday morning Looks Like for Rain. Started and Run about 5 lots and Chaind the same through the worst cedar swamp that my eyes ever beheld then Returned to camp all tired and hungery."

"10 Mar. Continued the line 2 miles then Returned to camp all hard running through the Enfurnal tamarack and Cedar Swamp.

Last night I acted a Little Part of the slight

hand by cutting a compass glass with a Jack Knife handle."

"12 Mar. Continue the line to West Boundary then returned to lot no. 33 there found Mr. X. Y., Frederick and Frousway and were not a little glad to see them. Mr. Y. had with him a little of black Betty which had been a stranger in our company for some time after some refreshment we removed our baggage on to lot no. 36."

"24 Mar. Two were gone after provisions and get some information concerning the work. The Remainder of the Party tapping trees and preparing for shugering, myself quite down at the heal tarried in Camp all day which greaved me to the very hart it being so good a day."

"Sunday 25 Mar. Men returned with provisions and Instructions of the next Proceeding work, they had with them one bottle of stingo."

A WINTER CAMP.

"28 Mar. Run the line about 2½ miles then Returned about sunset and arranged the Camp for night, run about ½ mile withe Pickets through a tamerack swamp as thick as hare on a dog.

"It would take nine men to hold one man's hat and coat it. this horable place. Looks like for rain this Eavening. to Lazey to cut wood but burn Bark this night. Henery to Lazey to carrey bark or pick boughs but sits and pants."

Besides the amusement one can get from diaries such as these, they give a satisfactory explanation to a surveyor of the crooked concessions and boundaries and the bad chainage he will meet with in retracing these old lines.

When the plain compass was almost the the only instrument used, in a co ıntry abounding in local attraction, to run lines without check across the whole width of a townsnip it need hardly be expected to find the lines parallel or straight, and when after being cut out probably just enough to see through, they were chained carelessly by ignorant assistants with untested chains occasional discrepancies in chainage need not be wondered at. And when to these reasons for inaccuracy we add the amount of Stingo and black Betty that was apparently used the only wonder is that they came out as well as they did.

The Little Rock & Hot Springs R. R. Co. has filed articles of incorporation for a line from Little Rock to Hot Springs, Ark. The Board consists of R. A. Edgerton, President; E. J. Butler, Secretary; C. T. Walker, Treasurer; Jas. A. Forres, E. J. Payn.

The River Seine.*

BY LEVESON FRANCIS VERNON-HARCOURT, M. A., M. INST. C. E.

(*Continued from Page 4.*)

II. INLAND NAVIGATION IMPROVEMENT-WORKS.

The Seine is an extremely winding river, which greatly increases the distance by water between the towns along its banks (Plate 2, Fig. 1). Thus the distance between Montereau and Paris, is forty-two miles in a straight line, and sixty miles by the river; between Paris and Rouen, seventy miles in a straight line, and 150 miles by the river; and forty-five miles from Rouen to the sea in a straight line, and eighty miles by the river and estuary. This large augmentation in the actual length to be traversed, however, though placing the inland navigation at a disadvantage in this respect as compared with railways, has the effect of reducing the fall of the river, which makes the river more stable, reduces the velocity of the current, and renders the canalization of the river easier. The total fall of the bed of the river is about seventy-four feet between Montereau and Paris (Tournelle Bridge), a distance of sixty-one miles, and about seventy-six feet between Paris and St. Aubin, a distance of 135 miles; so the average fall between Montereau and Paris amounts to fourteen and a half inches per mile, whilst between Paris and St. Aubin it is only six and three-quarter inches per mile. The fall and depth vary considerably at different parts, but are more irregular below Paris than above (Plate 2, Figs. 2 and 3).

Like most rivers, the Seine in its natural state consisted of a series of shallows and pools, causing irregularities in the current, which are always unfavorable to the up-stream navigation; whilst in times of drought shoals barred the passage. The only improvements effected on the Lower Seine, before the present century, consisted in narrowing the channel at certain places, called passes, so as to retain a greater depth of water over shoals higher up. The increased current, however, through these passes hindered the up-stream navigation; and forty horses were required for drawing a boat through the old pass of Morue, near Bezons.

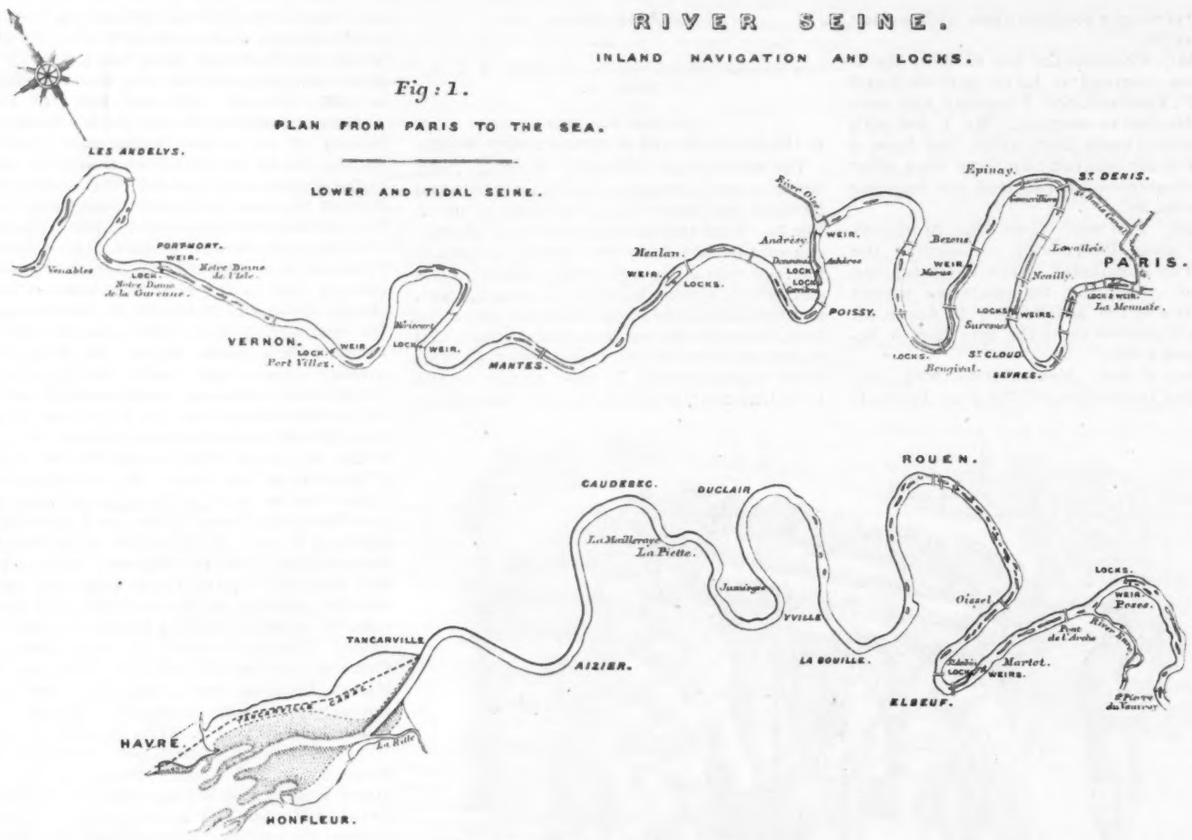
LOWER SEINE NAVIGATION WORKS.

The first distinct work of river improvement on the Lower Seine consisted in forming a side channel with a lock at Pont de l'Arche, where the old bridge acted like a weir. This work was commenced in 1804, and completed in 1813. Between 1813 and 1838, the river works were confined to the improvement and raising of the towing paths, and dredging shoals. As all the vessels at that time were towed up-stream by horses, great benefit was derived from an improved towing-path; but the removal of shoals proved of little practical advantage, for though the current was thereby rendered more uniform, its velocity was increased, and as the river was lowered fresh shoals appeared. At length, in 1838, the regular canalization of the river was undertaken between Paris and St. Aubin. Mr. Poirée had already successfully tested his system of needle-weirs within the Seine basin by erecting needle-weirs across the Yonne, at Basseville, in 1834, and at Epineau, in 1838, for providing an intermittent navigation by means of flushing on that river. He accordingly designed similar weirs, with adjacent locks, for canalizing the Lower Seine, and securing a depth of 5½ feet. Seven weirs, with their accompanying locks, were erected between 1838 and 1866, dividing the Lower Seine into seven reaches, namely, St. Aubin-Poses, nine and a quarter miles in length; Poses-Garenne, 25½ miles; Garenne-Meulan, 41½ miles; Meulan-Carriéras, 12½ miles; Carrieérs-Bougival, 16½ miles; Bougival Suresnes, 19½ miles and Suresnes to the Tournelle Bridge, 10½ miles long (Plate 2, Figs. 1 and 2). The river has a width of from 400 to 600 feet between Paris and Epinay; 500 to 750 feet between Epinay and Meulan; and 560 to 980 feet between Meulan and Rouen: and it is subdivided for considerable distances into two or more channels by numerous long islands. Advantage was taken in every instance of these islands for placing the locks and weirs in separate channels, sometimes at points at the river a considerable distance apart, as for instance in the case of Bezons weir and Bougival lock, which are as much as five and one-half miles from each other. Mr. Krantz, when proposing fresh works in 1871, stated that the great differences in the lengths of the reaches on such a regular river as the Seine constituted a notable defect in the above works. From an inspection, however, of the longitudinal section of the river below Paris (Plate 2, Fig. 2), it does not appear that the arrangement of the sites of the locks is open to objection, with the exception of the great gap left between the Garenne and Meulan locks, where the canalization was imperfect, forming an impediment to navigation in dry seasons.

On the completion of Mr. Poirée's navigation works, it was found that they did not secure, in times of drought, the anticipated navigable depth of 5½ feet, mainly because, in estimating the available depth in the upper portion of the reaches, credit was given for the inclination of water level due to the ordinary fall of the river between the weirs; whereas, after a succession of very dry seasons, the discharge of the river fell below its normal amount, and the water surface became nearly level. This loss of depth was naturally more marked at the upper parts of the reaches; but it must be attributed rather to the error in taking credit for an inclination of water-surface which might cease to exist, than to the unequal distribution of the weirs.

In 1866 fresh works were determined upon, not merely to remedy the deficiencies of the previous works, but also to increase the navigable depth to 6½ feet. These works consisted of an additional lock and weir at Port Villez for improving the depth in the long Garenne-Meulan reach, and the repair and raising of

*Read before the Institution of Civil Engineers, February 16, 1886.



THE RIVER SEINE.—Plate 2, Fig. 1.

the weirs and locks at Poses, Garenne and Meulan. Before these works, however, were completed, the need of a still more comprehensive scheme was recognized for providing a greater navigable depth between Paris and Rouen. The completion, however, of the works in progress, and the consideration of extended works, were delayed by the war of 1870-71. At length in 1878 fresh works were authorized, with the object of increasing the depth of the Seine between Paris and Rouen to 10½ feet, so as to secure a navigable channel for vessels of 800 to 1,000 tons burden, drawing 9 feet 10 inches of water. These works consisted in heightening or altering the existing weirs, so as to raise the water-level in the reaches; building larger and deeper locks; erecting a new weir and lock at Méricourt, between Port Villez and Meulan; and dredging at certain shoal places. The condition of the Lower Seine when all these works shall have been fully completed is shown on the section (Plate 2, Fig. 2). The river is divided into nine reaches, in which the depth is reckoned on the assumption that the water may at times stand perfectly level, so that the chance of an insufficiency of depth, owing to the absence of fall in a dry season, is eliminated; and the only possibility of a reduction in depth below the assigned limit of 10½ feet would be if the loss of water by leakage, evaporation and lockage, should ever in time of drought exceed the discharge. The falls at the locks are various, ranging between 5¾ feet at Meulan and 13¾ feet at Poses, whilst the average is 9½ feet; the total difference in level between the water-level of the Paris reach, and high water of ordinary neap-tides at St. Aubin, being 85 feet.

On the completion of the above works, the Seine will afford a very commodious waterway for inland navigation up to Paris. Large sea-going vessels get up to Rouen, which forms the terminus of an important inland trade by water with Paris and other parts of the country. A navigable channel, however, between Rouen and Paris, 10½ feet deep, does not satisfy every aspiration; and the idea of making Paris itself a seaport, which was first conceived in 1825, has been again revived. It is suggested that a tidal channel, with a minimum navigable depth of 19¾ feet, should be excavated along the river up to Poissy, 12½ miles from Paris, where a port would be created, and from whence vessels would be enabled, if necessary, to rise through a chain of locks to a higher reach and proceed right up to Paris. The comparatively small difference of about 50 feet in level between Rouen and the environs of Paris has led to the conception of such an apparently bold proposition, similar to the scheme designed by Mr. Fulton, for a tidal ship canal up to Manchester, but much greater in length, though less in maximum depth. The cost of the scheme has been estimated at £10,240,000. The government has not shown hitherto any disposition to further this scheme; and the Rouen authorities are naturally very strongly opposed to it. It would be wise to wait and see whether the greatly improved waterway between Rouen and Paris, now approaching completion, will not suffice to supply all the requirements of Paris, before attempting to burden the State, already deeply involved in several costly public works, with an enterprise of which the financial advantage is problematical. Rouen appears to be the neutral limit of maritime trade on the Seine (Plate 2, Fig. 2); and the improvement of the estuary channel between Berville and Havre (Plate 4, Figs. 1 and 2) is of far more pressing importance than the extension of the tidal river up to a point which, whilst involving a large expenditure and altering greatly the water levels in the upper valley of the Lower Seine, would not actually attain to Paris.

UPPER SEINE NAVIGATION-WORKS.

The improvement of the Seine for navigation between Montereau and Paris, by means of locks and weirs, was only undertaken in 1860, when the treaty of commerce gave an impulse to the methods of communication throughout France. Previously the upper Seine was quite open; and the only aids to navigation were the flashes coming down from the Yonne and Little Seine, which created a temporary flood, and augmented the depth whilst they lasted. These flashes were produced on the Yonne by rapidly opening the needle-weirs placed right across the river, of which the earliest was erected in 1834; but the small artificial flood produced by them only lasted about twelve hours in the Upper Seine, and only increased the depth from a maximum of 2½ feet at Montereau to 1 foot near Paris. In 1846 it was decided to erect weirs between Nogent and Montereau, so as to provide a similar system of flashes on the Little Seine, which, combined with the flashes of the Yonne, would increase the duration and height of the flood on the Upper Seine. In 1846 it was decided to erect weirs between Nogent and Montereau, so as to provide a similar system of flashes on the Little Seine, which, combined with the flashes of the Yonne, would increase the duration and height of the flood on the Upper Seine. In 1859, it was even proposed to extend the formation of the flashes to the Upper Seine itself by the erection of three movable weirs between Paris and Montereau; but this plan was superseded in 1860 by the decision to abandon the system of intermittent navigation, so prejudical to the passage of vessels up-stream.

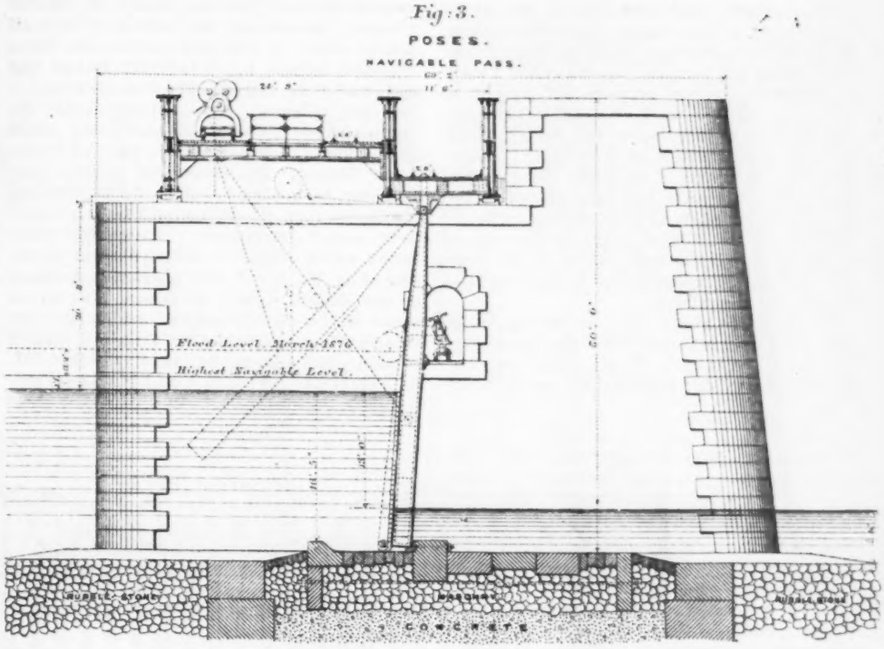
The scheme of 1860 consisted in the canalization of the Upper Seine by the erection of twelve weirs and locks, arranged so as to secure a navigable depth of at least 5½ feet over the lower sills of the locks, with the water standing level in the reach below. The

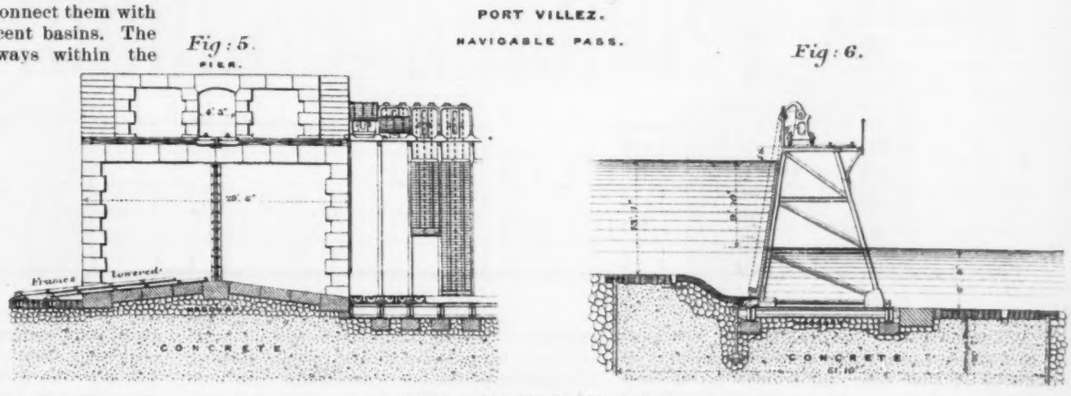
weirs were necessarily placed much closer, together than on the Lower Seine, owing to the greater natural inclination in the bed of the river above Paris; and they were so spaced that each weir kept up the water 7 feet 10½ inches above the summer level at its site. Mr. Chanoine, who had charge of the works, designed a system of movable shutters for closing the weirs, instead of the needle-weirs erected by Mr. Poirée on the Lower Seine (Plate 3, Fig. 8.) In 1878 it was decided to increase the navigable depth from 5½ to 6½ feet. This improvement has been effected by deepening the two top reaches, and lowering the sills of the lock at Varennes, and by raising the water-level in the other ten reaches which necessitated the reconstruction of the movable portions of the weirs (Plate 3, Figs. 8 and 9.) The present condition of this section of the river is shown on (Plate 2, Fig. 3.) The reaches vary in length from two and five-eighths miles between Courbeton and Varennes, to seven miles between Evry and Ablon; and the falls at the weirs vary between 4½ feet at Vives Eaux, and 8¾ feet at Port-à-l'Anglais, and average 5.6 feet. The change effected by the canalization is readily perceived by contrasting the present summer stage of the river, when the water is level in the reaches, with the summer water-level of 1840, when the river was in its natural condition (Plate, 2, Fig 3.)

The Oise, the Marne, the Yonne, and other tributaries of the Seine, have been rendered navigable by means of locks and weirs; and canals have been constructed to extend these inland navigations, and to connect them with the waterways of the adjacent basins. The length of navigable waterways within the Seine basin amounted in 1872, according to Mr. Krantz, to 1,585 miles; but he considered that several connecting links within the basin were needed, and also the junction of the Marne and the Saône by means of a canal.

WEIRS.

All the weirs on the Seine belong to the general class of movable weirs, though they present various differences in design. In fact, examples of all the principal types of movable weirs are to be found in the Seine basin. The needle-weir was for a long time the sole type adopted on the Lower Seine; whilst only shutter-weirs were erected on the Upper Seine. Drum-weirs have been confined exclusively to the Marne; and the only examples of the bear-trap-weir, the hydraulic shutter-weir, and the segmental gate-weir, are at La Feuville on the Marne, at Brulée Island on the Yonne, and at La Monnaie in Paris, respectively. The largest ordinary frame-weir in France has been erected at Port Villez, on the Lower Seine (Plate 3, Figs. 5 and 6;) whilst the first suspended frame-weir has been recently (September 17, 1885) completed across the Seine at Poses (Plate 3, Figs. 3 and 4.) The variety of types adopted within one river-basin has been due to the desire of the engineers in charge of the different sections to devise some new and improved type, and not to the special adaptability of each type to the localities in which they are situated. Thus Mr. Poirée erected needle-weirs on the Lower Seine and the Yonne; Mr. Chanoine placed shutter weirs across the Upper Seine; Mr. Desfontaines employed drum-weirs on the overfalls of the Marne; and Mr. Caméré is occupied in the construction of frame-weirs, suspended from overhead girders, for the new weirs on the Lower Seine.





Weirs. Plate 3. Figs. 3. 5. 6

The different kinds of movable weirs have been so fully described in the author's paper on "Fixed and Movable Weirs," read before this Institution in 1880, that a brief description will suffice of the general arrangement of the Seine weirs, together with some account of the modifications and improvements recently effected.

Upper Seine Weirs.—The weirs on the Seine are always composed of two distinct sections; namely, a navigable pass, used by vessels when the river is high and the lock is submerged; and a regulating weir with a sill raised above the river-bed, which, having consequently a less height, can be more readily opened for the passage of a moderate flood, and is more convenient for regulating the discharge than the larger weir of the navigable pass.

On the Upper Seine the navigable pass is placed between the lock, situated alongside the towing-path bank, and the regulating weir stretching from the river pier of the navigable pass to the opposite bank, as shown by the plan of Ablon weir (Plate 2, Fig. 7). The navigable passes on the Upper Seine vary in width from 132½ feet at Varennes and La Madeleine, to 213½ feet at La Cave, and their average width is 165 feet; whilst the regulating weirs vary from 124 feet at Melun, to 230 feet at the four lowest weirs. The sills of the passes are 3½ feet lower than the sills of the regulating weirs; and formerly both the passes and overfalls were closed by Chanoine's shutters.

In the recent improvement works, higher shutters have been placed on the old sills of the navigable passes, at the lower end of those reaches whose water-level had to be raised 1½ foot. These shutters resemble in principle the shutters they have replaced, but they have been improved in certain details (Plate 3, Fig. 8). The old shutters were liable to be fractured by the shock of their fall on being lowered; they were only raised to within 3 inches of the proper upper water-level, so that special contrivances were required to retain the full height of water in times of drought; a space of 4 inches was left between the shutters; and the shutters, having their axis of rotation situated one-twelfth of their height below the center, opened of their own accord when the upper water-level rose from 4 to 8 inches above them, and when the tail water was 6½ feet deep, which often happened in rainy years. The new shutters have been

made stronger; their crest rises to the proper water-level, 11 feet 2 inches above the bottom, their length on the slant being 11 feet 8 inches; their width has been increased to 4 feet 1 inch, reducing the interval between each shutter to 2 inches; and the axis of rotation has been placed only 1½ inch below the center, which secures the shutter from opening spontaneously. Moreover, a butterfly valve, 3¼ feet high and 2 feet wide, has been placed in the upper leaf of each shutter, which serves to regulate the water-level, to aid the passage of small floods, to ensure the safety of the shutters during larger floods, and to facilitate the raising of the shutters.

The shutters across the regulating weirs have been only retained where the water-level had not to be raised. In all other cases the shutters have been replaced by needle-weirs (Plate 3, Fig. 9). The needles, 11½ feet long and 3 inches square, have been furnished with hooks, so that they can revolve on the top front bar of the foot-bridge, which greatly facilitates their working.

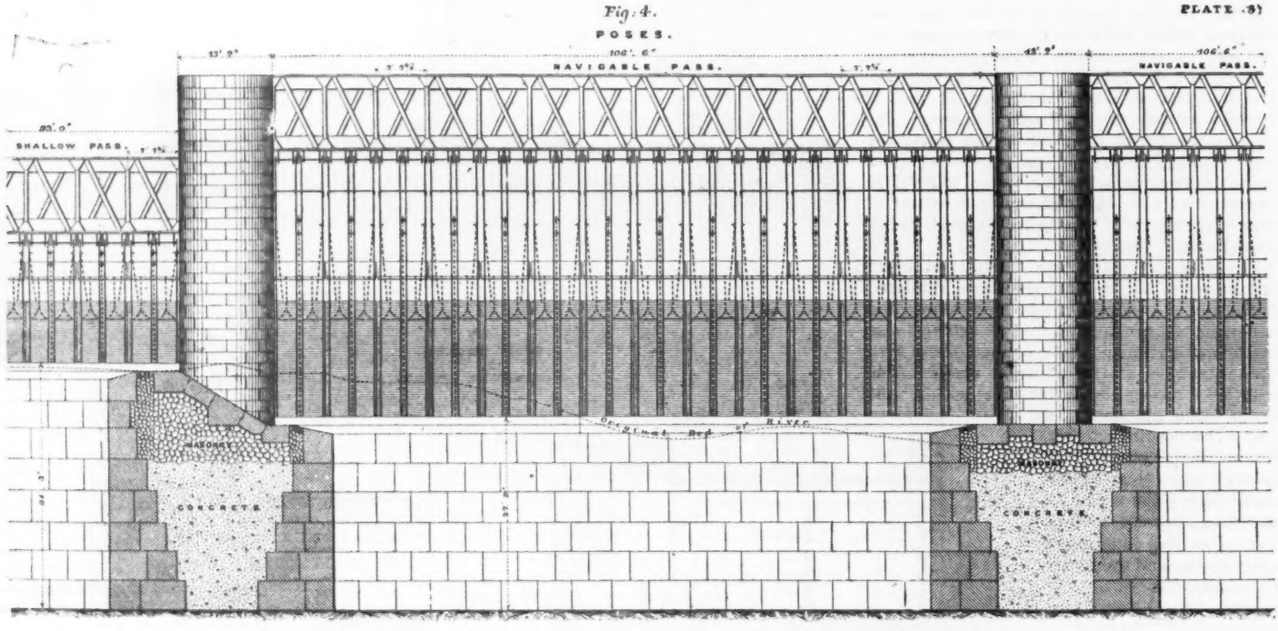
Needle and shuttle weirs are accordingly now found side by side on the Upper Seine, and both appear well adapted for a river with a fairly regular flow. Needles are simpler in construction, more easily moved, and less liable to get out of order than shutters; but they require the constant attention of the weir keeper for regulating the flow. Shutters allow of a moderate flood passing over their crest, and their extent of opening can be adjusted beforehand by their chains. The new weirs on the Upper Seine constitute a notable advance in the facility, rapidity, and security of working of these types of weirs.

Suresnes Weir.—The weir at Suresnes, a short distance below Paris, which formerly was a needle-weir precisely similar in construction to Martot weir, has been entirely reconstructed, in order to provide a minimum depth of 10½ feet as far up as Bercy by raising the water-level 3¼ feet. Formerly there was a weir adjoining the lock, another weir opposite Neuilly connecting Rothschild Island with another island in mid-stream, and a third weir between this island and the left bank at Levallois, two and a half miles below the lock. The great distance between the weirs was very inconvenient for working, and the raising of the water-level would have occasioned infiltrations through this long length of narrow islands. Accordingly the weirs have been all placed close to the lock, across the three channels formed by Rothschild Island and the small Folie Island. The system of frames has been retained on an enlarged scale, the frames across the navigable pass being about 20 feet high (Plate 3, Fig. 2), in place of 11 feet as at Martot. The system of needles has, however, been abandoned, as the needles requisite for such a height would be too heavy to be moved conveniently: the central regulating weir is closed by sliding panels, as designed by Mr. Boulé, and previously adopted at the Mulatière weir at Lyons, and at six weirs on the river Moskwa; whilst the two side-passes are closed by Mr. Caméré's hinged curtains, first adapted by him to the Port Villez weir (Plate 3, Figs. 5, 6, and 7). These two systems of closing large frame-weirs are accordingly being tested side by side at Suresnes. The sliding panels are cheaper and simpler in construction, and they let the water fall over the top, the upper ones being raised first. The hinged curtain, being rolled up from the bottom, makes the water escape below; it admits of a better adjustment of the discharge through the weir, and is not liable to be impeded by floods in the act of raising. The sliding-panel being submerged, is less easily worked, but the hinged curtain causes scour at the bottom; the one system has the merit of system and economy, the other possesses the advantage of more regular working. Time will demonstrate their relative durability, and whether the cheapness of the one more than compensates for the efficiency of the other.

The works at Suresnes were completed towards the close of 1884. Mr. Boulé, the Engineer-in-Chief of the works, thinks that a navigable depth of 14¾ feet, instead of 10½ feet, could have been realized with a not much greater expenditure of time and money; and he considers it possible that these new works may not exceed in duration the works of 1866-67, which they have replaced, in view of the prospect of extended improvements in weirs and increased acquirements for navigation.

Port Villez Weir.—The weir at Port Villez, near Vernon, unlike the older weirs on the Lower Seine, has been carried across the river where it is quite clear of islands, so that the weir forms a continuous line from the lock on the left bank over to the right bank. The total length of the weir is 700 feet. The weir consists of two central navigable passes, and a regulating weir on the right side of the river, which are separated by two intermediate piers (Plate 3, Fig. 5). The sills of the navigable passes are situated 13 feet 1½ inch below the upper water-level, and the sill of the regulating weir is only half that depth down. The weir is closed by frames of the Poirée type, supporting a series of Mr. Caméré's hinged curtains (Plate 3, Figs. 5 6, and 7). The frames are placed 3 feet 7½ inches apart; those across the navigable passes are 18 feet high, and weight 37⅛ cwt., and those on the overfall are 9 feet 2 inches high, and weigh 7⅛ cwts. The tops of all the frames are 1⅜ foot above the upper water-level, and carry a foot-bridge and a small tramroad, upon which the carriages for conveying the curtains run (Plate 3, Fig. 7). The weir cost £163.7*s.* per lineal foot. Works were begun in 1869 with a view to the erection of a pontoon weir, according to a novel design by Mr. Krantz; but a trial made of the system at Bougival having proved unsatisfactory, the design was abandoned, and the frame-weir eventually adopted was commenced in 1876. Since its completion in June, 1860, it has satisfactorily fulfilled all the requirements as regards navigation. The curtains are worked with ease, and have proved both water-tight and durable. The frames have not proved equally satisfactory, for, owing to their great height and weight, and the silting up of their resting-place in the river-bed, they are liable to be deflected, and even to be broken when lowered. The introduction, however, of a curve in the surface of the apron just above the weir (Plate 3, Fig. 6) keeps the floor of the frames clearer of silt, and has consequently reduced the chance of injury. Each frame can be raised or lowered in ten minutes; and the same time is occupied in rolling up or unrolling a curtain; whilst six minutes and two-thirds, on the average, suffice for conveying a curtain to its destination. The whole operation of opening or closing the weir completely occupies two and a half days, when a gang of four men is employed at the frames and another similar gang at the curtains, during the daytime only. This rate of work suffices for the Seine, but it evidently could be

Fig. 4. PLATE 3



Weirs. Plate 3. Fig. 4.

Fig: 1.

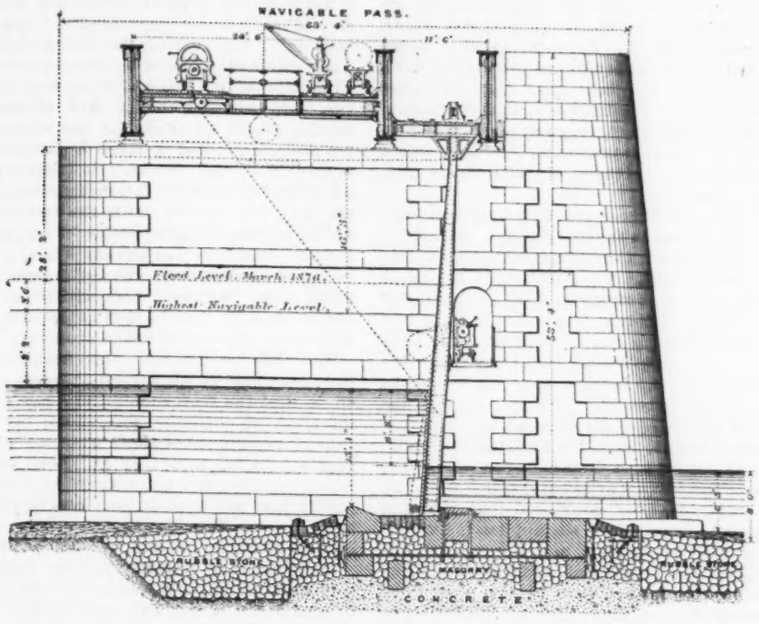
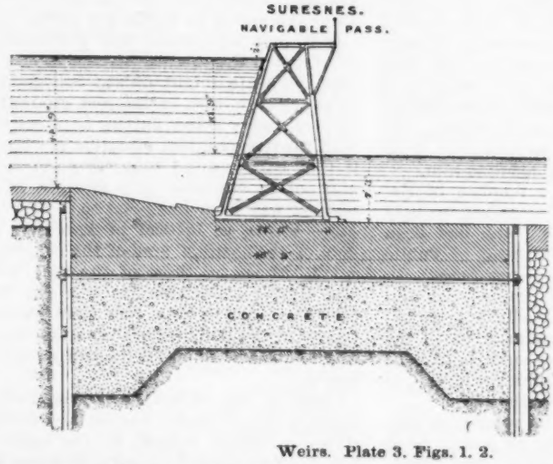


Fig: 2.



Weirs. Plate 3. Figs. 1. 2.

readily accelerated by working at night, or by employing more gangs.

Poses Weir.—Formerly the weirs of Poses were situated about half-a-mile apart, and more than a mile above the lock. The new weir has been erected across a wide branch of the river close to the locks, and only separated from them by the narrow end of an island. This weir has been constructed on an entirely novel principle; for though a system of lifted frames was suggested in 1873 by Mr. Tavernier for the Saône, Poses weir, designed by Mr. Caméré, is the first instance in which all the movable parts of the weir can be removed completely from the river-bed. The weir is of the frame type, and is closed with hinged curtains, like that at Port Villez; but the frames, instead of being fastened on to the apron and lowered on to the river-bed in flood-time, are suspended from an overhead girder, and, whilst their ends rest against the sill of the weir, when hanging vertically in place, they can be raised in flood-time to a horizontal position entirely out of the river (Plate 3, Fig. 3). This arrangement secures the frames from any chance of injury when the weir is open, and it greatly facilitates the working and maintenance of the frames. It, however, necessitates the adoption of long rames for the navigable passes, so that the frames when raised may afford a sufficient headway underneath for the passage of vessels in flood-time, and also overhead girders resting on high piers for supporting and lifting the frames. The great increase entailed thereby in the size of the works is most forcibly illustrated by Plate 3, on which the different types of weirs have been drawn to the same scale for the sake of comparison. Even Suresnes and Port Villez weirs, and the shutter-weirs of the Upper Seine (Plate 3, Figs. 2. 6 and 8), though the largest weirs of their class, sink into insignificance when compared with the hinged frame-weirs of Port Mort and Poses (Plate 3, Figs. 1 and 3).

The weir at Poses consists of seven openings separated by piers of which the two adjoining the left bank are navigable passes, 106½ feet wide, with sills 16 feet 5 inches below the upper water-level, and leaving a clear headway of 17½ feet above the highest navigable flood-level, 1½ foot higher than the ordinary level, but 3 1-6 feet below the flood of 1876 (Plate 3, Figs. 3 and 4). The three passes nearest the island are each 99 feet in width, and have their sills at the same level as the navigable passes; but their overhead girders are placed 8 feet lower in level than those of the navigable passes. The two central openings are also 99 feet wide, and have their girders at the same level; but their sills are 6½ feet higher than the rest of the weir (Plate 3, Fig. 4). There is a foot-bridge across the weir, and the levels of the girders are so arranged that the platform between the girders over the navigable passes is level with the platform on top of the girders across the other passes, so that the roadway of the bridge is at a uniform level throughout. Four verticals are braced together so as to form a single frame occupying 7 feet 7½ inches in width of the weir. A hinged plate at the back of each frame provides a small foot-bridge at the back of the weir, above the highest navigable flood-level, from which the curtains are rolled up or unrolled by aid of a crab (Plate 3, Fig. 3). The curtains are precisely similar in design to those of Port Villez, but they have been doubled in width, being 7½ feet wide, with a clearance of 1½ inch between them. The curtains are not removed when rolled up for opening the weir, but they remain on the frame whilst it is being raised by chains from the bridge, and even after it has reached its horizontal position, unless needing repairs (Plate 3, Figs. 1 and 3). The rolling up or unrolling of a curtain of one of the deep passes occupies fifteen minutes; whilst the raising of a frame occupies twenty minutes, and its lowering ten minutes. Consequently one of the passes could be entirely opened in five hours; and the whole weir would require from five to thirty-five hours for opening, according to the number of gangs employed.

The weir was put into operation in September, 1885. It cost £151 5*s*. per lineal foot, being less than that at Port Villez, notwithstanding the overhead girders, high piers, and long frames, as well as the greater head of water retained. The smaller cost of an apparently much larger work must be partly due to the less strength required for the frames, which are only exposed to the direct pressure of the water when the weir is closed, to the simpler apron in the absence of hinges at the bottom for the frames, and to the saving of the cost of modifications in the foundations and frames, and of experiments on the novel system of curtains, which were carried out at Port Villez weir. As the only objection that could be raised against the Poses type of weir would be the cost of so large a work, it is evident that if the expenditure on Poses and Port Villez weirs may be accepted as a fair comparison of the respective cost of the two systems, the suspended frame weir is decidedly superior to the ordinary frame-weir for heads of 10 feet and upwards. For while the suspended frame-weir is apparently not more costly than the ordinary frame-weir in these cases, it is more quickly raised or lowered, and more easily maintained. Moreover, this system provides a permanent foot-bridge, and it could readily be adapted for greater heights by merely having longer frames and higher piers.

Port-Mort Weir.—The intervening weir between Port Villez and Poses was formerly situated across the right branch of the Seine, at Notre Dame de l'Isle, about two miles above the lock of Notre Dame de la Garenne. The site of the weir has been changed, like at Suresnes and Poses, so as to place it near the lock; and the new weir is being constructed across the right branch of the river, in a line with the old-needle weir adjoining the lock. The needle-weir has simply been heightened, so as to retain a raised water level of 1½ foot. The new weir in course of construction consists of seven passes, each about 99 feet wide, separated by piers 13 feet in width, and having sills 13 feet 1 inch below the upper water-level. It is very similar in design to Poses weir, differing only from it in a few minor details (Plate 3, Fig. 1). The verticals are

(*Continued on page 29.*)

ENGINEERING NEWS

AND

AMERICAN CONTRACT JOURNAL.

TRIBUNE BUILDING, - NEW YORK CITY.

THE ENGINEERING NEWS PUBLISHING CO. PROPRIETOR.

VOL. XVI. Saturday, July 10, 1886.

CONDUCTED BY

GEO. H. FROST, - - - Assoc. Am. Soc. C. E.
D. McN. STAUFFER M.Am.Soc.C.E.: M.Inst.C.E.

TERMS OF SUBSCRIPTION.

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TABLE OF CONTENTS.

	PAGE
Canadian Government Surveys (*Illustrated*)	17
The River Seine (*Illustrated*)	19
Editorial Notes	24
Railways in China	24
Thomas C. Keefer, Vice-President U. S. of Civil Engineers	25
Personals	25
English and American Railroads Compared	26
List of Members of the American Society registered in Denver, Friday Evening, July 2, 1886	26
The Accident to the Great Eastern. A Slander Refuted (*Illustrated*)	28
Semi-Circumference of a Circle (*Illustrated*)	28
The Prismoidal Formula	28
Literature	30
Water	30
News of the Week	30
Foreign Notes	32
Market Report	32

THE N. Y. State Capitol, which has cost up to this time $17,500,000, is advertised to be sold on September 15th for arrears of Water Tax. The amount charged up against the building on the Treasurer's book is only $3.74—$1 is for water taxes, $2 for advertising, 50 cents for auctioneer's fees and the balance for sundries.

THE articles on Canadian Land Surveying, commenced in this week's issue, are supplementary to a series on the same subject published in the volume for 1876, which gave the experience of an "apprentice" seeking the diploma of a Provincial Land Surveyor; they are from the pen of a Dominion Land Surveyor, and will be most fully illustrated, the subject-matter and illustrations being from actual experience.

THE visiting members of the American Society of Civil Engineers in convention at Denver, this week are having a delightful time amid the wonderful mountains and cañons of Colorado. The meetings proper of the Convention closed on Monday, and excursions to Georgetown, Greeley and Leadville, terminating on Saturday at Manitou, have been the week's programme. The party spend Saturday and Sunday at Manitou in view of Pike's Peak and close to the "Garden of the Gods", and on Monday they start homeward from Colorado Springs. We publish this week a list of the party registered at Denver up to last Saturday; we will complete the list next week. We also publish an abstract of Mr. Dorsey's paper on "English and American Railroads Compared", together with a Table, which was down on the programme for discussion at Denver, on Monday.

Railways in China.

After the Tonquin war and the Peace of Tièn-Tsin, the Chinese government was generally credited by the European press of being about to construct several railway lines. Even the *termini* of the lines were given and some of the lines were so fully described that speculators in every land organized syndicates to send out representatives to try and obtain concessions in advance of their rivals from other countries.

The illusion did not last very long, and their only origin was in the imagination of English journalists, who, after the treaty of Tien-Tsin believed it might be possible by attacking China with a combination of international speculators to obtain whatever might be had and leave France out in the cold. The various letters published by these envoys in the Paris, Berlin and London papers a few weeks ago show the result. The first comers informed the Chinese government, to their great surprise, that it intended to build railroads; the succeeding ones were not even allowed to do so. The French syndicate, which relied on the treaty is now convinced that if China builds any lines, and if she applies to foreigners, it will be notified, and the other syndicates will also be notified, and that is all. The letter of Sir Robert Hart in the *Neue Freie Presse* of Vienna gives the last blow to any such hopes. It says in effect: (in answer to the Austrian Consul at Genoa), that every one in China was surprised at such reports; that indeed the railway question is twenty years riper than it was ten years ago, but that nothing could be done until the majority of the young Emperor, and that China offered no field for railway engineers at present. Sir Robert states that many applications from engineers had already been made to him.

In support of this view, a reporter of ENGINEERING NEWS had an interview recently with a French civil engineer, who had been during several years at the head of Public Works in one of the Chinese provinces. He showed extracts from three letters sent him by a Chinese minister, who is allied to the imperial family and one of the members of the regency. The enquirer was anxious to avail himself of such powerful influence in the, to be, forthcoming industrial movement.

We have been permitted to copy such passages of his correspondence as would be of interest to American engineers, and otherwise give his own expressions. In answer to a first general scheme, in which the technical and local questions were put aside in order to state general views and the consequent benefits that would accrue to the Empire, the minister replies through his secretary: "that although he agreed with his views, his Excellency regretted very much that he was not authorized to put into force the ideas you express so well. His Excellence regrets it the more so that it is hardly likely that he will ever be authorized to avail himself of these offers. But should it be otherwise, be assured that he will not fail to enter into correspondence with you, etc."

A few months afterwards, when the Tien-Tsin treaty had been concluded, believing with the papers that the era of iron and steam was decidedly about to begin in the Empire of the Middle, the gentleman renewed his proposition and went more fully into details of the scheme.

The reply, from the minister himself, this time, was to the following effect:

"I highly appreciate the very true and interesting observations that you have kindly sent me. They are, for me, a proof of your talents and what my country might expect from your services * * but"—here followed the same reasons for rejection as above, and still, the same conclusion, more marked this time, "Nevertheless, I shall not forget you, and should there be an opportunity, I shall not fail, etc" "The seal of the Empire followed. The gentlemen, however remembered the French proverb "*Qui veut la fin veut les moyens,*" and believing that a lack of technical details might be cause for the rejection of his proposal, risked a third application two months after the second. He obtained a reply in which occur the following passages: "I am very well pleased with the technical remarks in your communication * * but, not being authorized, as you already know, it would be better to wait until the Government asks me to make you such propositions, and you can be assured that in that case, your name will figure first on the list of proposals."

This was categorical. One authority said that the whole of his correspondence went to show that the Government had not only no intention of engaging foreigners, but even, that of getting rid of those who had engagements with it, according as these expired. All these latter will be replaced by the native pupils that are sent, at such cost to the government, to the Universities and special schools of Paris, London, Vienna and Berlin.

The Council of Regency believes that these very highly intelligent young men will be able to replace the trained and practical Europeans after a time. Of course, the treatment that Chinese have received abroad and the wish to keep the money at home, are potent factors.

Still, our informant was convinced that even under the existing circumstances a foreign syndicate might obtain concessions for railways even with an interest guarantee for foreign funds if the parties were conversant with the true political situation in China, and if they bore in mind that "in geometry only, and not in business, is a straight line, the nearest way from one point to another." In other words, if, instead of knocking at the door of the *nominal head* of the Empire, they would knock at those of the real leaders. The Emperor of China has as much right to give a concession for a line from Kashgar to Canton as the Emperor of Germany would have to grant concessions for lines in Bavaria and Saxony.

China is not, in fact, as is commonly supposed, a single state, but an assemblage of states, inhabited indeed, by the same race, but of different families, and differing as widely in language, religion and manners as the English and Spanish; while their relations to each other are no more friendly than those of the French and Germans in Europe. The Southern Chinaman believes that "Pekin" is the vilest word, while the Northern Chinaman believes the most despicable term is Fo-Kien.

"The kingdoms are governed by viceroys who merely recognize general customs laws, the political and religious supremacy of the emperor. The same legal code exists. But all this is more nominal than real. The recent war in Tonkin gave a striking instance of this, when the viceroy of Yunnan left his troops in garrison, while the Imperial forces were being cut in pieces. The viceroy of Fo-Kien kept his 40,000 soldiers in reserve, just as much to defend himself against the emperor as against the French. When the French entered on the Canton territory, it was quite another affair. The troops were marched against the invaders, who were forced to cross the frontier, but then the viceroy returned precipitately, so that the extraordinary spectacle was presented of two armies—the victorious and the vanquished—retreating at the same time. I have dwelt upon these matters because the fact being known to every one, its explanation may show us the weak points in

the armor. And it is by knowing them that a footing may be found for industrial affairs in the empire. The enemies of the emperor are not the enemies of the chiefs of the provinces, and it is not necessary that the friends of these latter should be friends of the former."

The gentleman concluded by saying that very probably it was this fear of showing a lessened authority that prevents the Regency from granting what it would be powerless to have performed if contrary views were opposed. If one of the provinces were gained over it would be likely that its neighbors would follow suit. It would be well worth while to try it, and it could be done for one-tenth of the funds intrusted to the first envoys, and with ninety-nine chances in a hundred of success.

Thomas C. Keefer, Vice-President American Society of Civil Engineers.

THOMAS COLTRIN KEEFER, one of the most successful civil engineers and public writers in Canada, was born at Thorold, near the Falls of Niagara, on the 4th of November, 1821. He is the grandson of a United Empire Loyalist, George Kieffer, an Alsatian Huguenot, who emigrated from France, and settled in the Province of New Jersey, before the American Revolution, where the father of the Canadian family, was born a British subject, in 1773. The *emigré* lost his life and property in the cause of the House of Hanover, and in 1790 George Keefer, his son, came to Canada, where he lived until 1858. His son Thomas was educated at Upper Canada college, 1833-1838, and in the latter year commenced the practice of his profession on the Erie canal. Returning to Canada he was engaged upon the Welland canal, where he was the division engineer until 1845, when he was appointed chief engineer of the Ottawa river works. After the successful completion of these works in 1848, the office was abolished, and in 1849 he employed his forced leisure, first, in writing the "Philosopy of Railroads," at the request of the president of the Montreal and Lachine railway company, and, secondly, in winning Lord Elgin's prize for the best essay on "The Influence of the Canals of Canada on her Agriculture." The "Philosophy of Railways" was widely distributed and translated into French, and earned for its author the right to be considered the father of railways in Canada, because its leading idea was, that, while the construction of railways could not be advocated in Canada as a commercial speculation on account of the sparsity of population, and competition of water communication, yet they were indispensible in order to prevent a wholesale emigration to the United States; and they would be so indirectly profitable that it was the duty of the government and the municipalities to aid to such an extent as would secure their construction.

In 1850 MR. KEEFER re-entered the government service for a short time in connection with the surveys for the navigation of the rapids of the St. Lawrence above Montreal, as well as of the connection by rail or canal of the St. Lawrence and St. John rivers, by the route of Lake Temiscouta. The following winter he was sent to Boston to assist the United States Consul, Mr. Andrews, in his first report in relation to a Reciprocity Treaty with Canada. Two years later he was called to New York by Mr. Andrews, who was then engaged with his second report. On the map prepared by MR. KEEFER for this report, the air line, from St. Paul via Sault Ste. Marie to Quebec, is laid down as showing the value of Canadian routes to the north western states of the Union. Mr. Andrews' report bears acknowledgment, as well as evidence of MR. KEEFER'S labors. These reports paved the way to the successful negotiation of the Reciprocity Treaty in 1854.

In 1851 MR. KEEFER was appointed to make the preliminary surveys for the Grand Trunk railway, and for the railway-bridge over the St. Lawrence at Montreal. As the winner of the prize essay, he was named by Lord Elgin, one of the Canadian commissioners for the first International Exhibition at London, 1851, which he visited. In the same year he gave evidence before Parliament in favor of the gauge of New York and New England as the proper one for Canada, and his views in this respect have been confirmed by the recent abandonment of the Canadian gauge.

In 1846 two eminent American engineers had reported upon the question of bridging the St. Lawrence at Montreal, where the winter display of ice is the greatest, and both had selected sites for draw-bridges in the wide water of the Laprairie basin, above the city, which would have required a very long superstructure, and have involved a considerable detour to reach the Portland railway. They considered that any attempt to bridge at the narrower part of the river near the city, would block the river so as to endanger both the bridge and the city. In his report MR. KEEFER demonstrated that the ice jams were due to the unnecessary breadth of the water way, and not only chose the narrower site at Point St. Charles, but proposed to shorten the superstructure by half a mile of solid embankment at each end, thus confining the current to the deeper channel, and preventing the grounding of the ice. He also abolished the draw, by raising the bridge over the navigable channel—approaching this with an ascending grade from either shore. The Victoria Bridge has been constructed upon the principles laid down in MR. KEEFER'S report, and, as twenty years experience has proved, without risk to the city or to the bridge.

MR. KEEFER was appointed engineer to the Montreal Harbor Commissioners in 1853, when the commissioners were engaged in deepening the channel between Montreal and Quebec. He recommended an extension from 16 feet, as proposed, to 20 feet depth, as not only required, but as relatively more economical: the cost of plant and preparation being in many places the chief item of expense.

MR. KEEEER has constructed water works for the cities of Montreal, Hamilton and Ottawa, and has been consulted with respect to those at Quebec, Toronto, Halifax, St. Catherines, London, and Dartmouth (N. S.) He has also filled the position of Chief Engineer to railways in Upper and Lower Canada, and has been consulted in harbor and bridge engineering in several provinces, and largely as arbitrator, solely or in conjunction with others, settling important disputes on public works.

In 1861, he advocated the construction of an interior line of railway from Lake Huron to Quebec, chiefly for defensive purposes, and has since the Fenian raids, urged the construction of the Toronto and Ottawa railway for the same reason. He has frequently pointed out our helplessness (as manifested at the time of the Trent affair and Fenian raids) so long as we are dependent on a single line of railway and that upon the frontier. In 1862, he was again appointed a commissioner to the International Exhibition at London, and visited England in connection with that duty.

Immediately after Canada extinguished the claims of the Hudson Bay Company to the great territory in the north-west, MR. KEEFER, in 1869, commenced a series of letters in the public press, to prove that this step fairly committed us to a Canadian Pacific railway although Confederation had not then extended to the Pacific ocean.

In 1877, MR. KEEFER was appointed the Executive Commissioner for the Paris Exhibition, and, while in that position, was named a member of the International Jury, for class 66, architecture and engineering. He received the most flattering acknowledgements from both English and French for the successful manner in which he discharged the arduous and important duties committed to him. France showed her appreciation by conferring upon him one of the higher grades of the Legion of Honor.

MR. KEEFER is a member of the Institution of Civil Engineers, London, and also of the American Society of Civil Engineers, of which he was some years ago elected the first Canadian director, and last January was elected Vice-President, the first Canadian chosen to fill that position.

As is here seen, the brief record of the life of MR. KEEFER is closely interwoven with the history of the International Improvements of Canada. The impress of his mind and hand is upon the grandest enterprises of the country, and his name will be remembered by future generations, as long as canals and railways are in use.

PERSONAL

L. B. DENNISON has been appointed engineer of the Healey ditch, Concord township, Delaware, O.

W. A. PRATT, Mem. Am. Soc. C. E., has been appointed Assistant Engineer and Roadmaster of the Philadelphia Division, Baltimore & Ohio R. R. His headquarters will be at Wilmington, Del.

THE wife of the Hon. John O'Brien, railroad contractor and chairman of the Democratic state committee, died suddenly at her home in Rhinebeck, July 2.

CITY ENGINEER LOWRY, of Denver, Col., has been invited to go to El Paso, Tex., to submit plans for a sewer system.

WALTER KATTÉ, Chief Engineer of the West Shore R. R., has been appointed Chief Engineer of the New York Central & Hudson River R. R., succeeding the late CHAS. H. FISHER.

THOMAS APPLETON has resigned his position as City Engineer of East Saginaw, Mich., to accept that of Chief Assistant Engineer on the Chicago, Milwaukee & St. Paul Railroad.

GEO. A. SCHELE, civil engineer, of Birmingham, Ala., has been appointed Principal Assistant Engineer of the Trans-Continental Railway, South Africa. MR. SCHELE will be assisted by MR. THOMAS O'BRIEN, civil engineer.

FRANK BARTLETT, C. E., late engineer in charge of the Sabille ditch tunnel, Wyoming Territory, having completed that work is now engaged on the Denver and Rio Grande Railway.

A. C. SAVAGE, Mem. Am. Soc. C. E., goes to San Juancito, Honduras, to take charge of wire rope tramways for the Rosario Mining Co. He sailed on the 8th inst. by the steamer "Colon" to Panama.

PROFESSOR GEORGE H. HAMLIN, professor of Civil Engineering at the Maine State College, has been appointed hydraulic engineer to conduct the series of surveys to be made in the Penobscot and Stillwater rivers to ascertain the flow at various seasons of the year.

JOEL B. DANDROW, an old resident of Plattsburg, N. Y., and a bridge builder for the Delaware & Hudson Railroad Co., was killed recently near Willsboro tunnel by jumping from a hand-car to avoid collison with a train.

A. J. CASSATT, the Mr. Kelso of the turf, is a fearless rider himself. He is also one of the most thorough railroad men in the country, having for some years been the First Vice-President of the Pennsylvania Railroad. Not long since he climbed up in the engineer's cab of a limited express at Jersey City just before she rushed off for Philadelphia, where, eighty-nine miles away, she was due in just one hour and fifty-two minutes. When about one-third the distance had been covered, Jim Sandford, the engineer, thought he would have some fun with CASSATT. He threw back the throttle further and further, and finally striking a down grade ran three miles in about two and a-quarter minutes, or at the rate of about seventy-

eight miles an hour. Sandford kept watching CASSATT, thinking he would show symptoms of fear. Not a bit of it. He sat like a statue, and, finally turning around, said: "Jim, are you winding her up for a race? She ought to be able to do a little better than this." When Sandford related the story, he said: "You can't scare Cassatt with either a thoroughbred or an iron horse."—*Record and Guide.*

ALFRED WILKINSON, of the firm of Wilkinson & Co., bankers, died at his home at Syracuse, N. Y., July 7th. He was born in Syracuse, August 17, 1831, graduated as a civil engineer at the Troy Polytechnic Institute in 1850, and in 1856 was Assistant Superintendent of the Lake Shore and Northern Indiana Railroad. He was appointed United States Revenue Collector for the Syracuse district by President Lincoln in 1862. He was formerly a member of the New York Stock Exchange and a member of the Century and Lotus clubs of New York.

English and American Railroads Compared.

We print on the opposite page a table comparing the cost of maintenance of way, repairs and renewals of locomotives, motive power and total operating expenses on the English and American roads mentioned, which is a part of Mr. Dorsey's additional paper on this subject on the programme to be read this week at the Denver meeting of the American Society of Civil Engineers.

The comparisons made in this table have never before been brought together and they, with the accompanying text, are worth the careful study of any one interested either in transportation or in the development of a country's wealth, for in addition to the table printed, Mr. Dorsey shows by comparing Colburn and Holley's figures for English traffic and American reports for 1855-56 with the current American and English reports, that "the English railroads, in economical workings and appliances, have apparently remained stationary during the last thirty years, while the American roads have improved so as to reduce the operating expenses more than one-half. On freight alone some roads have reduced their expenses and charges 80 per cent."

This fact, which Mr. Dorsey is the first to call attention to, was, as far as we know, unsuspected and will be pronounced incredible by those who have not collated the figures, but those for train mileage are taken directly from the reports mentioned, as are the American figures per tons and passengers, and no *reasonable* supposition as to English tons and passengers would help their economic showing.

While the figures are not incredible they are well nigh inexplicable unless they can be explained by some English railroad authority, for during this time that the traffic charges have remained stationary the capital account has been largely increased, the average capital per mile of all the railroads in the United Kingdom having increased from £34,106 in 1870, to £42,486 in 1884, or an average increase of $40,894.40 per mile, equal to 65 per cent. of the average capital account of the railroads of the United States; or, in other words, the "water" introduced into the capital of English roads in the last fifteen years is equal to 65 per cent. of the cost and the "water?" combined of American roads.

It will be noticed that the table, which includes many roads of small traffic brings out strongly the superiority of American locomotives as economical agents for transportation, fully justifying Sir Julius Vogel in his purchase of twenty American locomotives for the New Zealand government, even if they had been 20 per cent. dearer than the English engines instead of 20 per cent. cheaper, for in spite of our better wages and the greater loads hauled, the cost of repairs and renewals of locomotives per train-mile is no greater on American roads than on the English.

As a striking example of our better management of traffic, Mr. Dorsey takes the Knoxville branch of the Louisville & Nashville system, a road through a rough and sparsely settled country, with a traffic that only justifies eleven trains a day, and with an average cost of $26,464 per mile, 64.7 per cent. of the average *increase* of capital of all English roads in the past fifteen years, and compares it with the London & Northwestern as follows:

1884.	London and North West'n	Knoxville Branch.
Average Cost of Transporting One Ton, or One Passenger, One Mile.	Cents.	Cents.
Maintenance of way	.209	.404
Repairs and renewals of locomotives	.082	.061
Total cost of motive power	.271	.239
Total operating expenses	1.130	1.069

A comparison of the costs of maintenance of way and motive power per ton or passenger mile on the Pennsylvania with the London and Northwestern road shows, total for Pennsylvania .247 and on the London & Northwestern .472 cents.

The total of operating expenses are 82.9 and 65.9 cents per train mile and .5 and 1.12 cents per ton or passenger mile on the two roads. Credit should be given to the London & Northwestern for the shorter haul as is pointed out by Mr. Dorsey, which is offset to a certain extent by the greater density of population on its route.

England's manufacturers are localized to a greater extent than those of any other country, unless it is Belgium, but as the cost of transportation is still a tax on her production and is relatively a much larger tax than our freight charges are for vastly greater distances, she should, instead of striving to reduce wages and thus reducing the consuming power of her laborers, introduce our rolling stock and methods of railroading, which, without destroying the investment value of her roads would enable her to distribute her products at about one-third the present charges.

List of Members of the American Society Registered in Denver, Friday Evening, July 2, 1886.

H. L. Aulls, Omaha, Neb.; John W. Bacon, R. R. Commissioner, Danbury, Conn., and Mrs. Bacon; John F. Barnard, Supt. Kansas City, St. Joseph and Council Bluffs R. R.; St. Joseph, Mo.; Mrs. Barney, Pacific Junction, Ia.; Edward Baumann, Architect, Chicago, Ill., Mrs. Baumann; Miss Baumann, and Master Baumann; William R. Belknap, Louisville, Ky.; Thomas S. Bishop, New Britain, Conn.; Henry Blabbner, St. Louis, Mo.; Henry I. Bliss, La Crosse, Wis., and Mrs. Bliss; John Bogart, *Secretary*, Am. Soc. C. E., and Mrs. Bogart, New York City; C. M. Boggs, Toledo, O.; A. Bonzano, Vice President and Chief Engineer, Phœnix Bridge Co., Phœnixville, Pa., and Mrs. Bonzano; Hubert Bonzano, Phœnixville, Pa.; Wm. F. Booth, Poughkeepsie, N. Y.; C. M. Brown, Toledo, O.; Andrew Bryson, Brooklyn, N. Y.; Clifford Buxton, Chief Engineer, Ohio Valley R. R., Toledo, O., Mrs. Buxton and Miss Buxton; W. W. Card, Secty. Westinghouse Air Brake Co., Pittsburg, Pa.; Octave Chanute, Consulting Engineer, Kansas City, Mo.; Eliot C. Clarke, Engineer Mass. State Drainage Commission, Boston, Mass.; Wm. B. Cogswell, Treasurer and General Manager, Solvay Process Co., Syracuse, N. Y., and Mrs. Cogswell; Mendes Cohen, Baltimore, Md., Mrs. Cohen and Miss Cohen; Francis Collingwood, Consulting Engineer, Elizabeth, N. J.; J. James R. Croes, *Treasurer*, Am. Soc. C. E., Chief Eng. Suburban Rapid Transit R. R., New York City, and Miss Croes; D. W. Cunningham, Grandin, Dakota; Joseph P. Davis, Consulting Engineer, New York City; Frederick De Funiak, President New Orleans Elevated R. R. Co., Louisville, Ky. and Mrs. De Funiak; E. Dickenson, Denver, Col.; Thomas Doane, Crete, Neb., and Mrs. Doane; S. B. Downes, New York City; E. W. Eckert, Massillon, O.; Howard N. Elmer, St. Paul Minn.; Geo. D. Emerson, Professor of Engineering, School of Mines, Rolla, Mo.; C. A. Ferry, Asst. City Engineer, New Haven, Conn., and Mrs. Ferry; H. H. Filley Resident Engineer, Mexican National Railway, City of Mexico; Clark Fisher, Proprietor of Fisher Rail Joint Works, Trenton, N. J.; Henry Flad, *President*, American Society of Civil Engineers, St. Louis, Mo.; Robert Fletcher, Professor Civil Engineering, Thayer School of Engineering, Dartmouth College, Hanover, N. H.; S. Waters Fox, St. Joseph, Mo.; Carl Gayler, St. Louis, Mo.; Chas. E. Goad, Montreal, Canada; Bryant Godwin, New York City; B. H. Greene, Helena, Montana, and Mrs. Greene; Chas. E. Greene, Professor of Civil Engineering, University of Michigan, Ann Arbor, Mich.; Geo. S. Greene, Jr., Chief Engineer, Dock Department, New York City, and Mr. Carlton Greene; E. B. Guthrie, Buffalo, N. Y.; Wm. G. Hamilton, New York City; Wm. J. Haskins, New York City; Rudolph Hering, Consulting Engineer for Main Drainage of Chicago, Mrs. Hering and Master Hering, Chicago, Ills.; Chas. A. Hinckeldeyn, Engineer Attaché Imperial German Legation, New York City; H. V. Hinckley, Topeka, Kan., and Mrs. Hinckley, Miss Bessie O. Hinckley; M. L. Holman, St. Louis, Mo.; F. B. Howard, Detroit, Mich.; William R. Hutton, Consulting Engineer, New Croton Aqueduct Commission, New York City, Mrs. Hutton and Miss Hutton; Wm. A. Jeffers, New York City; J. B. Johnson, Professor Civil Engineering, Washington University, St. Louis, Mo.; H. F. Juengst, St. Joseph, Mo.; Thomas C. Keefer, *Vice-President*, Am. Soc. C. E., Ottawa, Canada, Mrs. Keefer and Miss Keefer; Geo. A. Kimball, City Engineer, Somerville, Mass.; G. W. Kittridge, Zanesville, O.; Charles Latimer, Cleveland, O.; Thomas B. Lee, *Assistant-Secretary*, Am. Soc. C. E., New York City, and Mrs. Lee; W. S. Lincoln, St. Louis, Mo.; William H. Lotz, Chicago, Ill., Mrs. Lotz and Miss Lotz; Charles Macdonald, Union Bridge Co., New York City, and Mrs. Macdonald; Mrs. Henry G. Morris, Philadelphia, Pa.; David E. McComb, Asst. Engineer, District Government, Washington, D. C.; Robert E. McMath, Sewer Commissioner, St. Louis, Mo.; John J. McVean, Chief Engineer, Detroit, Lansing and Northern R. R., Iona, Mich.; M. W. Mansfield, Indianapolis, Ind., and Mrs. Mansfield; J. W. Meier, Meier Iron Works, St. Louis, Mo.; Thomas C. Meyer, New York City; Robert Moore, St. Louis, Mo.; Henry G. Morse, Morse Bridge Co., Youngstown, O.; John Nichol, Chicago, and Mrs. Nichol; J. B. Nicholson, Chief Engineer, Cincinnati Southern R. R., Cincinnati, O.; Albert F. Noyes Engineer, Water-Works West Newton, Mass.; Fred. S. Odell, Asst. Engineer, Suburban Rapid Transit R. R., New York City; John F. O'Rourke, Prairie du Chien, Wis.; Mrs. Wm. H. Paine and Miss Paine, New York City; Franklin C. Prindle, Civil Engineer, U. S. N., East Orange, N. J., and Mrs. Prindle; N. C. Ray, Omaha, Neb.; David Reeves, President Phœnix Bridge Co., Philadelphia, Pa., and Mrs. Reeves; Geo. S. Rice, Georgetown, Col.; W. W. Rich, Chief Engineer, Minneapolis and Sault Ste. Marie R. R., Turtle Lake, Wis.; Joseph R. Richards and Mrs. Richards, of the Mass. Inst. of Technology, Boston, Mass.; T. F. Richardson, Architect, Boston, Mass., and Mrs. Richardson; William Roberts, Waltham, Mass., Mrs. Roberts, and Mrs. John Hulburt; Andrew Rosewater, City Engineer, Omaha, Neb.; R. W. Ryan, New York City; Pemberton Smith, Buffalo, N. Y.; Robt. B. Stanton, Denver, Col.; Geo. F. Swain, Professor of Civil Eng., Mass. Inst. of Technology, Boston Mass.; H. A. Swenson, St. Paul, Minn.; Stevenson Towle, Consulting Engineer, New York City, and the Misses Towle; A. W. Trotter, New York City, and mother; John G. VanHorne, Jersey City, N. J., and Mrs. VanHorne; Miss VanHorne, Jersey City, N. J.; Y. Wada, Tokio, Japan; Montgomery Waddell, New York City; T. W. Walker, Pittsburg Bridge Co., Pittsburg, Pa; John F. Wallace, Keithsburg Bridge, Keithsburg, Ill., and Mrs. Wallace; Chas. D. Ward, Jersey City, N. J., and Mrs. Ward; James R. Wardlaw, New York City; F. W. Watkins, New York City, and Mrs. Watkins; William Watson, Boston, Mass.; A. M. Wellington, *Railroad Gazette*, New York City, and Mrs. Wellington; Thomas J. Whitman, Chief Engineer, City Water-Works, St. Louis, Mo.; William H. Wiley, representing ENGINEERING NEWS, and *Engineering*, of London, New York City, Mrs. Wiley and Miss Wiley; C. M. Woodward, Dean of Washington University, St. Louis, Mo., and Mrs. Woodward.

Urbana, O.—A new contract has been proposed by the water-works company by which the town will secure two and one-half miles of additional pipes, thirty-two additional fire hydrants (making a total of 110), another main pipe connecting the pumping works and the circuit of the city, new pumping machinery to give a capacity of 4,000,000 gallons per day. For all this the city pays $6,050 for 110 hydrants; against $7,200 for seventy-six hydrants as at present. Water will be furnished free for public buildings, free cisterns, and free public watering troughs free public fountains, etc.

The Iron City Bridge Co. hold the contract for the iron shed of the great passenger depot to be erected at once in Philadelphia for the Baltimore and Ohio Railroad Co. The depot will be 360 feet long by 110 wide and three stories in height.

TABLE No. 45.

Comparing the Cost of Maintenance of Way, Repairs and Renewals of Locomotives, Motive Power, and Total Operating Expenses.

NAME OF RAILROAD	YEAR.	Average Length of Line Operated.	Aggregate Daily Trains Over Entire Line.	Average Cost per Mile.	Average Load of Trains.			Total Cost of Maintenance of Way.		Total Cost of Repairs and Renewals of Locomotives		Total Cost of Motive Power.		Total Cost of Operating Expenses	
					Tons.	Passengers.	Tons and Passengers.	Per Train Mile.	Per 1 Ton or 1 Passenger Moved 1 Mile.	Per Train Mile.	Per 1 Ton or 1 Passenger Moved 1 Mile.	Per Train Mile.	Per 1 Ton or 1 Passenger Moved 1 Mile.	Per Train Mile.	Per 1 Ton or 1 Passenger Moved 1 Mile.
UNITED KINGDOM. £ = $4.80. d = 2 cents.		Miles.						Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Caledonian	1882	.....	.....	.....	.....	.....	.....	10.46	.....	.....	.....	15.26	.....	62.40	.....
	1883	877	43	.....	69	37	55	9.54	.174	5.06	.092	15.92	.290	63.64	1.16
	1884	878	45	.....	64	35	51	10.08	.198	5.22	.102	16.26	.302	60.26	1.18
Great Eastern	1882	.....	.....	.....	.....	.....	.....	10.48	.....	.....	.....	17.32	.....	64.42	.....
	1883	1 049	42	.....	69	45	55	10.30	.188	5.30	.096	17.88	.325	63.04	1.15
	1884	1 038	43	.....	68	46	55	9.96	.180	5.06	.092	17.12	.311	61.24	1.11
Great Northern	1882	.....	.....	.....	.....	.....	.....	9.64	.....	.....	.....	15.20	.....	59.68	.....
	1883	768	68	.....	61	35	48	9.50	.198	4.00	.083	15.50	.322	58.72	1.23
	1884	783	69	.....	60	34	47	9.20	.196	4.02	.086	15.24	.324	56.24	1.20
Great Western	1882	.....	.....	.....	.....	.....	.....	14.30	.....	.....	.....	15.14	.....	59.92	.....
	1883	2 268	42	.....	65	45	55	14.22	.259	5.80	.105	15.26	.277	60.04	1.09
	1884	2 301	42	.....	64	44	54	13.80	.255	.....	.....	15 38	.285	59.34	1.10
Great Southern and Western of Ireland	1882	.....	.....	.....	.....	.....	.....	15.48	.....	.....	.....	18.66	.....	69.40	.....
	1883	478	19	.....	74	40	54	17.28	.320	6.00	.111	18.62	.345	68.94	1.28
	1884	496	19	.....	73	37	52	16.26	.313	5.96	.115	18.18	.350	67.30	1.30
Lancashire and Yorkshire	1882	.....	.....	.....	.....	.....	.....	12.56	.....	.....	.....	19.26	.....	77.32	.....
	1883	494	84	.....	99	42	66	12.78	.194	.....	.....	17.52	.267	78.12	1.14
	1884	496	88	.....	96	41	64	12.46	.195	.....	.....	16.20	.253	71.06	1.11
London and North Western	1882	.....	.....	.....	.....	.....	.....	12.40	.....	.....	.....	15.10	.....	66.54	.....
	1883	1 793	68	.....	78	39	59	11.90	.202	4.60	.078	15.40	.261	65.52	1.11
	1884	1 811	68	.....	78	38	58	12.14	.209	4.78	.082	15.72	.271	65.66	1.13
London and South Western	1882	.....	.....	.....	.....	.....	.....	13.60	.....	.....	.....	16.90	.....	73.28	.....
	1883	721	49	.....	71	51	56	12.78	.228	5.42	.097	16.66	.298	71.58	1.28
	1884	722	49	.....	69	51	56	13.06	.233	5.42	.097	19.38	.346	71.46	1.27
London, Brighton and South Coast	1882	.....	.....	.....	.....	.....	.....	9.82	.....	.....	.....	18.06	.....	66.52	.....
	1883	403	63	.....	91	56	63	9.96	.158	4.24	.067	18.20	.289	66.08	1.05
	1884	417	62	.....	83	55	61	9.80	.161	4.48	.073	17.94	.294	63.70	1.05
Manchester, Sheffield and Lincolnshire	1882	.....	.....	.....	.....	.....	.....	9.26	.....	.....	.....	14.36	.....	66.18	.....
	1883	314	66	.....	77	35	62	8.92	.160	.....	.....	14.90	.248	65.48	1.06
	1884	316	69	.....	75	34	60	8.80	.147	.....	.....	14.26	.238	65.02	1.08
Midland	1882	.....	.....	.....	.....	.....	.....	10.18	.....	.....	.....	14.94	.....	56.18	.....
	1883	1 381	76	.....	61	33	50	9.50	.190	5.24	.105	15.80	.310	56.30	1.12
	1884	1 388	76	.....	61	33	50	8.96	.180	5.06	.101	15.34	.301	56.52	1.13
North Eastern	1882	.....	.....	.....	.....	.....	.....	12.78	.....	.....	.....	20.60	.....	69.14	.....
	1883	1 534	51	.....	78	37	62	12.36	.199	7.84	.126	21.24	.343	67.74	1.10
	1884	1 534	49	.....	76	35	59	12.38	.210	8.34	.141	21.50	.364	67.78	1.15
South Eastern	1882	.....	.....	.....	.....	.....	.....	11.08	.....	.....	.....	17.54	.....	74 44	.....
	1883	370	55	.....	83	66	71	10.78	.152	3.88	.055	18.02	255	74.74	1.05
	1884	369	59	.....	82	62	66	9.94	.151	3.92	.060	17.22	.261	70.58	1.07
All the Railroads of the United Kingdom	1882	18 457	.....	£41 605	.....	.....	.....	12.28	.....	.....	.....	16.42	.....	64.94	.....
	1883	18 681	46	42 417	73	43	57	12.02	.211	.....	.....	16.64	.291	64 34	1.13
	1884	18 864	46	42 486	71	42	55	11.64	.211	.....	.....	16.70	.304	63.18	1.15
All the Railroads of England and Wales	1882	.....	.....	.....	.....	.....	.....	12.12	.....	.....	.....	16.74	.....	65.68	.....
	1883	13 218	54	49 258	73	44	57	11.74	.206	.....	.....	16.96	.300	64 84	1.14
	1884	13 340	54	49 854	72	43	56	11.44	.204	.....	.....	17.04	.304	63.96	1.14
UNITED STATES.															
Pennsylvania Railroad Division	1883	1 314	53	.....	189	45	152	17.6	.116	7.1	.047	24.5	.161	86.	.56
	1884	1 471	43	.....	205	42	160	16.4	.103	7.	.044	23.8	.148	84.5	.53
	1885	1 518	46	.....	210	45	167	13.2	.080	6.2	.037	22.2	.133	78.2	.41
New York Central and Hudson River	1883	.....	.....	.....	205	71	160	21.7	.134	6.8	.042	34.3	.214	123.2	.77
	1884	993	53	.....	196	60	147	18.8	.128	5.2	.035	26.6	.180	108.5	.74
	1885	993	56	.....	195	70	150	15.1	.100	4.9	.033	24.8	.165	92.8	.63
Louisville and Nashville System, Main Stem	1883	185	21	$85 405	149	40	109	13.15	.121	4.51	.041	20.60	.190	85.31	.783
	1884	185	23	86 373	145	59	112	10.46	.093	4.64	.041	20.57	.184	85.39	.762
	1885	185	21	86 804	149	58	114	10.96	.096	4.13	.036	18.67	.164	81.58	.716
Nashville and Decatur	1883	119	15	37 198	153	39	116	17.48	.151	4.57	.039	20.47	.176	103.94	.896
	1884	119	15	37 420	161	49	125	13.59	.109	4.68	.037	21.06	.168	97.21	.777
	1885	119	15	37 769	162	64	128	12.57	.098	4.16	.033	20.25	.159	91.39	.714
South and North Alabama	1883	189	17	55 357	129	34	103	21.18	.205	4.66	.045	19.67	.191	89.45	.869
	1884	189	18	55 521	134	45	107	15.32	.143	4.74	.044	19.48	.182	87.00	.813
	1885	189	19	55 818	117	57	101	10.99	.109	4 25	.042	18.57	.184	75.57	.748
Mobile and Montgomery	1883	179	12	36 059	137	43	105	23.12	.220	4.56	.043	19.07	.181	95.38	.908
	1884	179	13	36 119	129	52	104	28.38	.273	4.67	.045	19.42	.187	104.36	1.000
	1885	179	14	36 154	143	75	104	22.91	.220	4.09	.039	18.18	.175	92.42	.889
New Orleans, Mobile and Texas	1883	141	12	73 052	150	64	110	18.74	.170	4.34	.039	20 86	.190	99.08	.901
	1884	141	12	73 195	143	80	112	22.08	.197	4.54	.040	21.61	.193	107.	.955
	1885	141	12	73 241	138	93	114	16.05	.141	3.91	.034	20.78	.174	94.07	.843
Knoxville Branch	1883	171	4	28 200	134	42	91	50.78	.558	4.33	.048	21.25	.233	111.81	1.229
	1884	171	10	26 464	122	39	88	35.53	.404	4.60	.052	21.04	.239	93.94	1.069
	1885	171	11	26 024	126	31	91	22.16	.243	4.14	.045	19.11	.210	74.55	.819
Memphis Line	1883	258	10	35 667	100	32	69	24.26	.352	4.36	.063	18.65	.270	83.74	1.213
	1884	258	9	35 702	110	39	76	22.82	.300	4.53	.059	19.65	.260	84.58	1.113
	1885	258	9	35 710	126	34	81	21.84	.270	4.00	.049	19.44	.240	84.36	1.041
Henderson Division	1883	151	14	41 782	126	27	93	22.17	.238	4.57	.047	19.68	.212	82.76	.890
	1884	151	13	41 854	148	42	116	25.00	.216	4 76	.041	19.77	.170	93.77	.808
	1885	151	13	41 904	182	45	125	15.98	.128	4.25	.034	17.29	.138	80.60	.645
St. Louis Division	1883	208	8	33 108	109	32	74	34.08	.460	4.35	.060	16.45	.223	102.97	1.391
	1884	204	9	33 297	109	33	73	32.17	.429	4.56	.061	17 04	.217	101.41	1.352
	1885	208	9	33 372	122	32	82	28.32	.345	4.06	.049	15.86	.194	93.35	1.139
Cincinnati Division	1883	110	17	44 469	113	41	80	16.87	.201	4.34	.054	21.04	.263	107.81	1.348
	1884	110	18	44 689	125	51	92	15.78	.171	4.56	.049	21.26	.229	106.86	1.161
	1885	110	19	44 391	135	45	95	14.53	.153	4.05	.042	18.98	.200	103.11	1.086
Lexington Branch	1883	67	10	44 469	103	37	60	38.14	.638	4.03	.067	18.63	.310	96.84	1.614
	1884	67	11	44 538	130	48	90	27.71	.308	4.39	.048	19.16	.213	88.63	.985
	1885	67	11	44 564	165	40	91	20.95	.230	3.90	.043	17.84	.200	78.73	.865
Chicago, Rock Island and Pacific	1883	1 384	22	52 203	109	53	93	17.12	.180	3.31	.035	16.83	.177	77.50	.817
	1884	1 384	25	52 963	110	49	94	14.08	.150	3.53	.037	16.85	.177	72.43	.767
	1885	1 384	22	53 221	106	52	93	14.67	.158	3.18	.034	18.08	.194	74.32	.804
Philadelphia and Erie	1883	287	26	.....	268	44	221	25.61	.115	9.32	.042	31.17	.141	107.14	.473
	1884	287	26	.....	279	38	221	21.15	.096	9.57	.043	28.03	.127	90.58	.423
	1885	287	26	.....	288	35	229	18.06	.079	7.77	.034	25.48	.111	83.10	.360

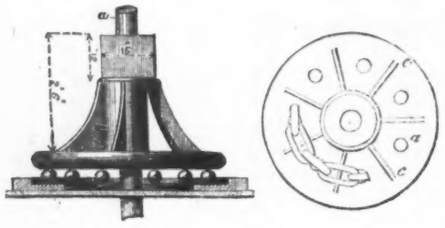
The Accident to the Great Eastern. A Slander Refuted.

HARVARD UNIVERSITY,
LAWRENCE SCIENTIFIC SCHOOL,
CAMBRIDGE, MASS., June 24, 1886.

EDITOR ENGINEERING NEWS:

In *The Engineer* of May 7th, 1886, there is a statement in regard to the "Great Eastern" steamship, which, as it is evidently incorrect, and as it concerns an American engineer, ought not to pass without notice. This statement is "a sensational story was told at the time about the fitting of a jury steering gear by an American engineer, Mr. Towle, which, like many other sensational stories, is not true."

The facts in the case appeared in the newspapers of the day, and Mr. Towle's arrangement for steering the ship was fully described and illustrated in the *Scientific American*. It would take too much space to describe it again, but the fact that Mr. Hamilton Ela Towle *did*



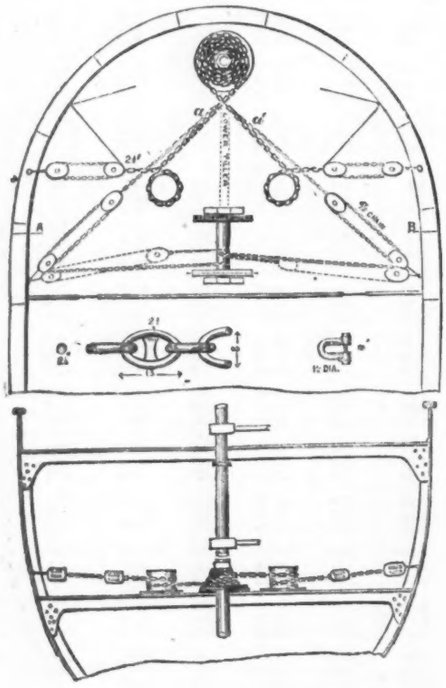
contrive and apply a successful steering apparatus is shown by the following:

The passengers on the Great Eastern presented Mr. Towle with a gold watch bearing this inscription "Presented to Hamilton E. Towle, C. E., by the passengers on board the steamship "Great Eastern," September 12, 1861.

"WM. PATTON, D. D.
"MONTGOMERY GIBBS,
"Committee."

The Life Saving Benevolent Association, of New York, gave him their medal with this inscription:

"Presented to Hamilton E. Towle for his ingenious contrivance of a steering machine which he fitted to the steamship Great Eastern under circumstances



of great peril and subsequently of complete success in saving numerous passengers and that noble ship."

The "Great Eastern" was libelled in the United States Court before Judge Betts in May, 1862, the claim being for $100,000. The ship was allowed to sail under bonds for $10,000. The case was tried before Judge Shipman, whose decision was rendered November 12, 1864. This decision is printed in the New York *Times* of November 14, 1864. The judge gave him full credit for his services, and a verdict for $15,000.

The Engineer, which now contains this statement that the story of Mr. Towle's services is not true, published in its issue of September 27, 1861, an illustrated description of Mr. Towle's steering apparatus, and then gave him full credit.

Mr. Towle received anything but fair and courteous treatment from the officers of the "Great Eastern" at the time, and this recent attack on his record may proceed from some of the statements which were then circulated to injure him and bring credit to themselves.

W. S. CHAPLIN.

Temporary Stearing Gear of the Great Eastern.

(From *The Engineer*, September 27, 1861.)

On the occasion of the recent disaster to the Great Eastern she lay unmanageble in the trough of the sea for nearly three days. The rudder post, a wrought iron forging, 10 inches in diameter, had broken off below the main-tiller, and about a foot in length of what ought to have been sound iron was found broken into lumps, of from 6 pounds to 8 pounds weight down to coarse powder. The rudder was thus left swinging to the sea, and there was apparently neither the chance of securing it, nor controlling it, if secured. Orders were given to pass a stout chain around the rudder blade, and to get a "purchase" for the chain upon the rudder post, with the intention of bringing the chains inboard and to the wheel. From the form of the rudder the chain could not be got to hold, slipping up as soon as any strain was brought upon it. This attempt occupied much time, men having to be lowered overboard, after the sea had fallen off from its original violence in order to get at the rudder. The post had broken off about 2½ feet above the deck of the *lower* steering room, and partly within a nut, 15 inches in diameter and 12 inches high by which the weight of the rudder post was supported upon a heavy casting, the bottom of which, about 3 feet in diameter moved with the rudder and upon balls, as shown in the annexed sketch. Men had been sent to get this nut off from the broken end of the post, and by dint of much labor it had been raised about 1¼ inches. At this stage of proceedings Mr Hamilon E. Towle, civil engineer, of Boston, U. S., and who was a passenger on board, called the Captain's attention to the fact that the nut probably supported the most of the weight of the rudder, which, if thus disconnected, might soon become entirely unmanageable, if it were not indeed lost. Mr. Towle, at the same time, suggested a plan for obtaining control of the rudder; which plan, upon consideration, the captain adopted, and he entrusted Mr. Towle with the general direction of the arrangements for its execution, placing a large force of men at his disposal. This was on Saturday evening, the 14th inst. Mr. Towle first set about screwing on the nut already referred to, the rudder, with its post, having already dropped the 1¼ inch through which the nut had been raised. No wrench was sufficient to screw up against the whole weight of the rudder, but by slipping on the wrench at the right moment when the sea had knocked the rudder to the port side, and then making the wrench fast, the power of the sea, on the returning swing to starboard, was brought into play, and the nut at last got home to its proper seat. Mr Towle then ordered up 15 fathoms of the heaviest chain cable on board, the links being made of 2½ inches bar. After much laborious effort, the ship rolling heavily during the whole time, the cable was got down upon the stump of the rudder post, and carried three times around the casting above referred to. The ribs on this casting gave a hold to the cable, and thus a sort of chain drum, about 3¼ feet in diameter, was extemporized. The ends of the cable were then carried around a pair of stout bits standing near by, and afterwards secured to the sides of the ship by strong block tackle. A shackle was then locked in each swing of the cable, and to each shackle a 1¼ inch chain was made fast. The steering tackle from the wheel was then laid on to the 1¼-inch chain, and the steersmen took their posts again on Sunday evening. The 2½-inch cable was kept nearly taut upon the bits, except when the rudder had to be moved considerably out of the ship's course. Too much slack having been let out on the cable, a sea at last knocked round the rudder, taking the wheel out of the quartermasters' hands, and killing one of them on the spot, an accident which could hardly have happened had the cable been kept as taut as Mr. Towle wished.

Mr. Towle's services appear to have been highly appreciated by all on board, and the passengers, before leaving the ship, passed the following among other resolutions:

"That we would also acknowledge with deep thankfulness the sense we entertain of the valuable scientific suggestions of one of the cabin passengers, Hamilton E. Towle, of Boston, U. S., Civil Engineer, made in order to repair the injuries sustained by the steering apparatus of the vessel, and of the patient attention with which, at much personal inconvenience, he assisted Captain Walker until the ship was enabled again to proceed.

"That some suitable testimonial of our appreciation of the skill and services of Mr. Towle be provided and presented to him by the passengers."

"Mr. Towle has since left for home in one of the Liverpool steamers.

[The above correspondence and article speak for themselves. Mr. Towle graduated from the Lawrence Scientific School, Harvard University in 1855. He had charge of building the basin, floating dock and Marine railway at Pola, Austria. He died in London in 1871.

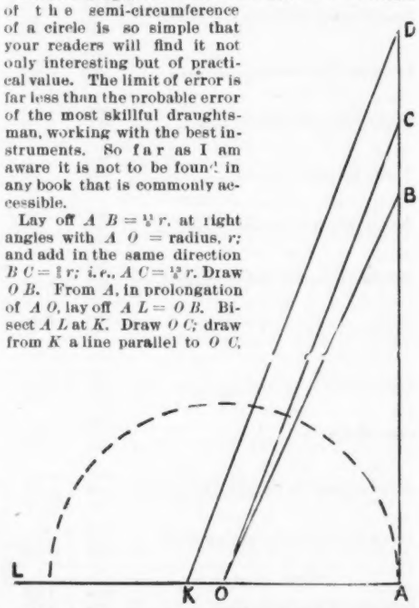
It is very proper that Prof. Chaplin should defend the reputation of Mr. Towle, and we are pleased to be able to lay so clear a case before the readers of this journal. We feel certain that our contemporary must have forgotten the circumstances connected with the case when he allowed an expression of petty jealousy to gain access to its columns and so thoroughly contradict its own words published near the time of the accident and which it is now in order to reconcile.—ED. ENGINEERING NEWS.

Semi-Circumference of a Circle.

THAYER SCHOOL OF CIVIL ENGINEERING,
HANOVER, N. H., June 25, 1886.

EDITOR ENGINEERING NEWS:

The following geometrical construction of the length of the semi-circumference of a circle is so simple that your readers will find it not only interesting but of practical value. The limit of error is far less than the probable error of the most skillful draughtsman, working with the best instruments. So far as I am aware it is not to be found in any book that is commonly accessible.



Lay off $A\ B = \frac{1}{8}\ r$, at right angles with $A\ O$ = radius, r; and add in the same direction $B\ C = \frac{1}{7}\ r$; *i. e.*, $A\ C = \frac{15}{56}\ r$. Draw $O\ B$. From A, in prolongation of $A\ O$, lay off $A\ L = O\ B$. Bisect $A\ L$ at K. Draw $O\ C$; draw from K a line parallel to $O\ C$, cutting $A\ C$ produced at D. Then $A\ D = \pi .\ r$, almost exactly, *i. e.*, to within .0000007.

Proof. $O\ B = \sqrt{O\ A^2 + A\ B^2}$; $A\ K = \frac{1}{2} O\ B$, by construction. $A\ O : A\ K :: (A\ B + B\ C) : A\ D$. Numerically, considering radius = 1, $O\ B = \sqrt{(\frac{15}{8})^2 + 1} = \sqrt{5.84} = 2.416609192$. $\therefore A\ K = 1.208304596$. Then the proportion gives $A\ D = \frac{15}{8}\ A\ K = 3.14159149$.

The correct value of π to the seventh place of decimals is 3.1415926. Hence the error of this construction is .0000007. Q. E. D.

This construction will be found in *Journal de Crelle* (Crelle's Journal), Vol. 3, p. 83. My attention was called to it recently by Prof. A. S. Hardy, of Dartmouth College.

Yours truly,

R. FLETCHER.

The Prismoidal Formula.

DICKINSONS LANDING, ONTARIO.
June 28, 1886.

EDITOR ENGINEERING NEWS:

To refer once again to the method of using alternate cross sections as middle areas for the computation of earthwork by prismoidal formula.

The numerical example chosen in my last letter, has not, I allow, a natural looking profile; the level cross sections giving plane surfaces were chosen, merely to simplify the example. The person entrusted with the computation of earthwork is often unacquainted with the ground, and I think should adhere strictly to the information given in the level book.

The leveller is supposed to take his sights sufficiently close to shape out the surface of the ground, both on center line and cross section.

There is another difficulty arises in connection with this method. Which set of cross sections are to be chosen as middle areas, the odd numbers or the even? They will in nearly all cases give different results, and with an undulating ground surface the difference may amount to a large percentage. These are difficulties which have prevented me adopting this method of computation which in many cases would prove a great saving of time.

Yours truly,

G. E. ROBERTSON, B. A. Sc.

(*Continued from page 23*)

braced together in pairs, each frame being separated by an interval nearly equal to its width, so that each curtain, having the same width as at Poses, will overlap its frame on each side, and meet the adjacent curtains in the center of the intervals between the frames. The overhead girders are all placed at the same level, so that when the frames are raised there is a clear headway of 16½ feet above the highest navigable level, as at the navigable passes at Poses. Owing, however, to the much greater height of the navigable level above the normal level, the frames have to be longer, and the piers higher than at Poses.

Fig: 7.

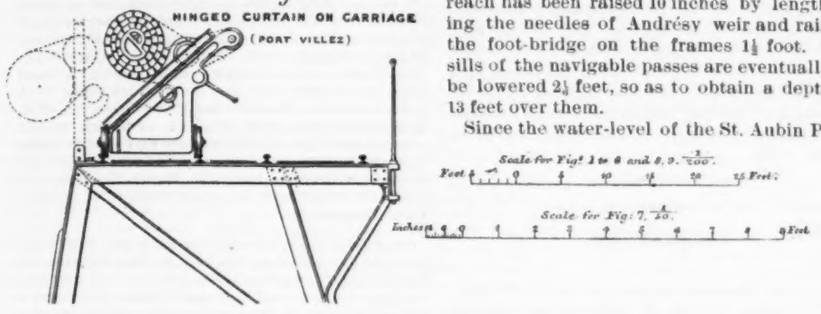


Plate 3. Fig 7.

though the normal head is 4½ feet less. (Compare Plate 3, Fig, 1 with Fig. 3). The difference between the upper and lower water-levels is less at Port Mort than at Suresnes rnd Port Villez, or even than at the Upper Seine weirs, so probably a cheaper form of weir might have been adopted in this instance.

Meulan and Méricourt Weirs.—The improvement-works comprise the reconstruction of Meulan weir, and the construction of an additional weir at Méricourt between Meulan and Port Villez.

Meulan weir is situated where the river is separated into two channels by an island; and the new weir is designed to have two navigable passes, having a total width of 243 feet, and a shallow pass, 115 feet wide, across the left branch of the river and adjoining the locks on the left bank; whilst another weir stretches in the same line across the right branch, having a width of 256 feet.

Méricourt weir, in course of construction, extends in an unbroken line from the locks on the left bank to the opposite bank. It consists of two navigable passes adjoining the lock, having a total width of 213 feet, and two shallower passes with a total width of 485 feet.

The navigable passes of both these weirs are to be closed by suspended frames supporting hinged curtains, resembling Port-Mort weir; whilst the other portions of the weirs will have ordinary frames with curtains, like Port Villez weir.

Bezons, Andrésy and Martot Weirs.—The two weirs between Suresnes and Meulan, at Bezons and Andrésy, and the lowest weir on the Seine at Martot, require so little modification to provide the increased depth, that it is not proposed to change their sites, although Martot weir is half a mile away from St. Aubin lock, and Bezons and Andrésy weirs are a considerable distance from their corresponding locks, at Bougival and Carrières-sous-Poissy (Plate 2, Fig. 1). As the water-level of the Bougival-Suresnes reach is to remain unaltered, no raising of the needle-weir at Bezons is necessary; but it is proposed at some future time to lower the sill of the navigable pass 3½ feet, so that it may be 13 feet below the upper water-level.

The water-level of the Carrières-Bougival reach has been raised 10 inches by lengthening the needles of Andrésy weir and raising the foot-bridge on the frames 1½ foot. The sills of the navigable passes are eventually to be lowered 2½ feet, so as to obtain a depth of 13 feet over them.

Since the water-level of the St. Aubin Poses reach is not to be altered, the needle-weir at Martot will need no modification, except at the navigable pass, when the proposed lowering of its sill 3½ feet is carried out.

UPPER SEINE WEIRS.

Fig: 8.

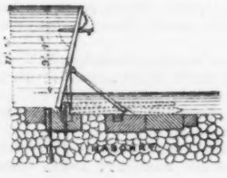


Fig: 9.

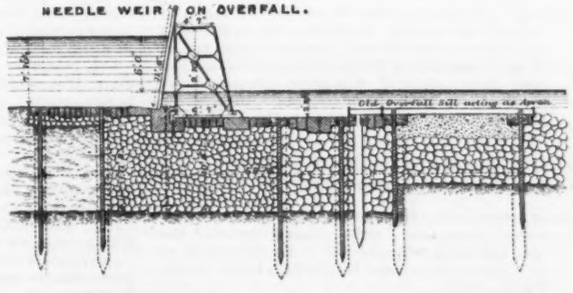


Plate 3. Figs. 8, 9.

LOCKS.

Upper Seine Locks.—The twelve locks on the Upper Seine adjoin the weirs. Eleven of these locks have pitched slopes of 1 to 1 at the sides; they are 55½ feet wide at the surface-level of the lower pool, which is 6½ feet above the bottom, and the available length of the lock-chamber is 564 feet. The lock at Port-à-l'Anglais, just above Paris, has vertical side-walls: its chamber has an available length of 590 feet, and a width of 52½ feet. The entrance width of these locks is 39½ feet.

Lower Seine Locks.—Previous to the commencement of the works, authorized in 1878, for increasing the depth of the Lower Seine to 10½ feet, there were single locks at each of the weirs, with lock-chambers about 394 feet long and 38½ feet wide. At Bougival, where the traffic is the greatest, the old lock has an intermediate pair of gates. The new works comprised the construction of enlarged locks, with their lower sills 10½ feet below the water-level of the lower pools, supplemented in most instances by a smaller lock alongside, to prevent unnecessary waste of water in locking smaller vessels. The lock-chambers of the large locks are 462 feet long and 55½ feet wide, and of the small locks 197 feet long and 27 feet wide. The available entrance width, however, at the gates of the large locks is retained at 39½ feet as in the old locks. The lock-chambers at Suresnes and Bougival have been given the greater lengths of 526 and 722 feet respectively. Some of these locks have been completed, as, for example, at Suresnes, Bougival, Carriéres, and Meulan, and the remainder are either in process of construction or are projected. In some cases three locks will in future supply the requirements of navigation, as, for instance, at Bougival, Garenne, Poses, and St. Aubin; but Meulan and Port Villez will be served by the old lock and the new large lock only, as no provision has been made for a small lock; at Suresnes, the small lock has been added in prolongation of the old lock; whilst at Méricourt there will only be the large and small locks of the new type, as no lock has existed there before.

COST OF INLAND NAVIGATION-WORKS.

In considering the cost of the works for improving the navigable capabilities of the Seine, it must be borne in mind that the works on the Upper, and still more on the Lower Seine, as they exist at present, are the results of successive experimental trials and alterations so that the total expenditure has been much greater than would be required for the actual erection of the existing works.

Cost of Upper Seine Works.—The twelve weirs and locks between Montereau and Paris cost originally £432,500, or about £36,000, on the average, for each weir and lock. These works, completed in 1873, increased the navigable depth from less than 2 feet in dry weather up to 5½ feet. The lock at Port-à-l'Anglais was deepened in 1869, and a new navigable pass formed in 1870, at a cost of £23,880, which is included in the amount given above. The lock cost about £16,000, out of the total of £36,000: the navigable pass, retaining a depth of water of 10 feet on its sill, cost £37 10*s.* per lineal foot; and the regulating weir, with its sill 3½ feet higher, cost £21 15*s.* per lineal foot, including £4 12*s.* for the foot-bridge on movable frames added in 1869. The deep pass at Port-à-l'Anglais, with a depth of 13 feet on its sill, and a foot-bridge, cost £62 6*s.* per lineal foot.

The works for raising the navigable depth of the Upper Seine from 5½ to 6½ feet have involved an additional expenditure of £240,000 between 1878 and the end of 1884. These works are now completed; and Mr. Boulé considers that a further sum of £47,500 would amply suffice for these weirs for some years to come, which would raise the total expenditure on the twelve weirs and locks to £720,000, or an average of £60,000 for each weir and lock. Mr. Lavollée estimates the annual cost of maintenance at £3,480 on the average.

Cost of Lower Seine Works.—Some of the weirs and locks comprised in the improvement-works authorized in 1878 are as yet unfinished, so that the total cost of the works cannot be ascertained. A sum of £412,000 was allotted in 1846 for the execution of the works for ensuring a naviable depth of 5½ feet. In 1866 a further expenditure of £260,000 was decreed. Mr. Krantz stated, in his Report to the National Assembly in 1872, that the total expenditure on the Lower Seine since the beginning of the century had amounted to £1,058,000; but of this, only £657,300 had been expended on weirs and locks, the remainder having been devoted to dredging, protection of banks, towing-paths, embankments, and accommodation for vessels. The estimated cost of the new works for securing a depth of 10½ feet, authorized in 1878, was £1,280,000; and a further expenditure of £420,000 was allowed in 1880 for the special purpose of extending this increase in depth from the Concorde Bridge right through Paris. This raises the total estimated expenditure on weirs and locks in the Lower Seine to £2,372,000.

Various details of the actual and estimated costs of the new works are given in Mr. de Lagrené's report for 1881, from which it appears that the cost of the lock and weir at Port Villez, including repairs of the frames and alterations in the sills of the passes, amounted to £234,940; the Bougival locks cost £112,800; the Carriéres sous-Poissy locks and cut, £104,600; the Meulan lock and cut cost £95,430; and the estimated cost of the weir and locks at Méricourt was £240,000.

NAVIGATION.

Upper Seine Navigation.—The width of the navigable channel of the Upper Seine varies from 115 to 164 feet. The vessels navigating this section of the river convey loads of from 100 to 350 tons of merchandise; they go in trains, for, as the trade is mainly towards Paris, the same tug which conveys the loaded vessels down stream can tow the vessels when empty up stream. Traction by horses or men has almost disappeared on the river since the improvements in depth, and the vessels are towed either by a tug hauling on a sunken chain or by an ordinary steam-tug.

The traffic on the 60½ miles of the first section of the Seine, between Montereau and the entrance of the St. Martin canal, which Mr. Krantz reckoned at about 1,245,000 tons of merchandise in 1868, and which did not exceed 1,500,000 tons before the increase in depth from 5½ to 6½ feet, reached 2,100,000 tons in 1882, and 2,300,000 tons in 1883, showing the impulse given to the river traffic by the improved facilities for navigation.

Lower Seine Navigation.—The tonnage of the vessels regularly navigating the Lower Seine varies from 250 to 500 tons; but when the river is high, vessels of nearly 800 tons pass along, and as soon as the works in progress are completed, the river will be available for vessels of 1,000 tons. Comparatively few vessels are now towed by horses, and only those of the smallest class. Traction is generally conducted on the Lower Seine by one of the following methods: steamers carrying cargo; steamers both carrying cargo and towing; steam-tugs; portable steam-propellers fixed at the stern of the vessel; the tugs hauling on an immersed chain.

The Lower Seine is divided into sections, namely, the second section of the Seine, from the end of the first section, at the entrance of the St. Martin canal, down to the mouth of the Oise just above Andrésy weir, a distance of 25¾ miles; and the third section, from the mouth of the Oise to Rouen, having a length of 107 miles (Plate 2, Fig. 1). Owing to the considerable amount of traffic brought into the second section from the Upper Seine and the Oise for Paris, and the imperfect canalization of the third section, the traffic per ton-mile in the third section was only a little in excess of that in the second section in 1868, in spite of the great difference in their lengths, amounting to 53,334,000 ton-miles in the second, section, and 58,421,000 tons-miles in the third section. By 1878, however, the traffic in the second section was somewhat reduced, whereas the traffic in the third had increased, amounting respectively to 49,504,000 ton-miles and 68,033,000 ton miles. In 1881, the traffic per ton-mile in the second section again approximated to that of the third section, being 67,656,000 ton-miles as compared with 71,351,000 ton-miles in the third section, owing probably to the development of traffic from the Upper Seine. The traffic, however, of the third section has made a rapid advance since 1881, having attained 84,713,000 ton-miles in 1884.

Hydraulic machinery has been provided at the Bougival locks for working the gates and sluices, and for the hauling of vessels through the locks, because a considerably larger number of vessels pass through these locks than through any of the other locks on the Lower Seine. This is due to the passage through the Bougival locks of all the vessels from the Oise bound for Paris, as well as those coming up the Seine; whilst some of them afterwards diverge into the St. Denis canal below Suresnes. The traffic through the locks at Suresnes, though notably less than at Bougival, is far ahead of that through the locks below Bougival.

The navigation of the river is free both by day and by night, no tolls being charged, for the lock-keepers are paid by the State, and are bound to pass vessels at any time when required, receiving an extra payment for each lockage effected at night. The locks and weirs are lighted at night with colored lamps so as to indicate the navigable channel, and some of the bridges are also lighted for navigation; and special regulations exist relative to the lights to be exhibited at night by vessels on the river.

TO BE CONTINUED.

LITERATURE.

Report of the Water Commissioners of the City of Troy N. Y., for the year 1885 P. H. BAEHMAN, Chief-Engineer.

Report of the Chief Engineer of the Department of Engineering and Surveying for the city of Wilmington, Del. 15th annual; for 1885. Chief Engineer FREDERIC H. ROBINSON, 1st Asst. GEO. H. BOUGHMAN.

Report of Chief Engineer C. N. DANENHOWER of the Board of Public Works of the city of Cincinnati, O., for the year ending December 31, 1885.

Report of the Board of Public Works of the State of Ohio for the year ending November 15, 1885. FRANK SNYDER, Chief Engineer, 47th annual.

Report of the Sewer Committee of the City of Schenectady, N. Y., including the Ordinance and Specifications. W. B. LANDRETH, City Surveyor and Inspector of Sewers.

From the Office of Naval Intelligence. Papers on Squadrons of Evolutions and the Recent Development of Naval Matériel. June, 1886.

From the Institution of Civil Engineers: Hardening of Cement. By PROF. W. C. UNWIN. *Strength of Steel and Wrought-Iron Girders.* Abstract from Report of Dutch Minister of Public Works. *Rail Joints and Steel Rails.* By C. P. SANDBERG. *Experiments in the Discharge of Water of Different Temperatures.* By JOHN GEO. MAIR. *The River Seine.* By L. VERNON HARCOURT.

Catalogue and Circular of the University of Illinois, Urbana, Ill., 1885 86. 110 pages, 8 vo.

Announcement of the Faculty of Applied Science. McGill College, for session of 1886-7. *Annual Report of McGill University*, 1885. *Circular of the Department of Civil Engineering.* Mass. Institution of Technology, Boston, Mass.

Seventh Annual Report of the Ohio Society of Surveyors and Civil Engineers, 1886. Price 50 cents. Copies for sale by F. J. Sager, C. E., 81 N. High street, Columbus, Ohio.

Proceedings of the 5th Annual Meeting of the Missouri Association of Surveyors and Civil Engineers held at Columbia, Mo., June 4, 5 and 6, 1885.

Report of the Water Board of the City of Newton, Mass. for the year ending Dec. 31, 1885. This is a Model Report, and as the Water Registrar ALBERT S. GLOVER is the Secretary of the New England Water Works Association, and the Engineer, ALBERT F. NOYES, an enthusiastic member of the Association, it may well be understood that they have endeavored to prepare as excellent a report as it was possible to make.

Report of the Waluppa Water Board. Fall River, Mass. 19th Annual, to Dec. 31, 1885. The Chimney of the Pumping Station of this Works was struck by lightning; the core was cracked for 40 feet, and rendered it dangerous to be taken down. It was shot down after the pumping house had been well protected. Total expense $6000.

Report of the Board of Water Commissioners of the city of Minneapolis, Minn., for the year ending March 1st 1886. J. W. HENION, Superintendent.

Report of the Board of Water Commissioners of Amsterdam, N. Y. 5th Annual for the year ending April, 30 1886. A. H. DEGRAFF, Superintendent and Engineer.

Report of the Superintendent, WM. HAMILTON, of the Toronto, Canada Water Works for the year ending Dec. 31, 1885.

WATER

SHELBYVILLE, ILL.—The water works were finished and successfully tested on the 5th inst. Works consist of: 1st, Source of supply, an infiltration well on banks of Okan river and direct connection with river for emergencies. 2d, Two Worthington compound duplex pumps of 1,000,000 capacity each. Two 50-horse power, Whittier tubular boilers, in brick pump house 3d, A stand pipe 125 feet high, 12½ feet diameter, of boiler steel, made by Shickle, Harrison and Howard Iron Co., of St. Louis, Mo. 4th, Six miles of mains, of 12-inch, 10-inch 8-inch, 6-inch and 4-inchpipe, with fifty double-nozzle Ludlow hydrants, twenty-three Ludlow valves and two ornamental drinking fountains. Messrs. Comegys and Lewis, of 45 Cortlandt St., contractors; S. H. Lockett, Chief Engineer.

DELAWARE, O.—The Committee on Water-Works has reported that under Section 2,702, Revised Statutes, the City Council is prohibited from entering into any contracts, and that should the council decide to authorize the construction of water-works, additional legislation will be needed before creating a board of water-works trustees as required by law, exempting the council from the provisions of the above Section or authorizing the issuing and selling of bonds; meanwhile, until additional legislation is had, it is the opinion of the committee that the council should postpone final action for want of proper authority in the premises. With regard to the site for the location of the plant, the committee recommend that the engineer, Mr. J. D. Cook, be required to report on three additional sites. They recommend the payment of $250 to the engineer, and the balance of $250 upon the receipt of his report on these latter sites. The committee's report on the legislation required is referred to the City Solicitor.

CIRCLEVILLE, OHIO,—The City recently advertised for proposals for furnishing the city with water for fire protection and the inhabitants with water for domestic purposes: franchise to be given to the lowest responsible bidder for a term of twenty years unless purchased by the city; the system to be stand pipe or direct pressure; source of supply, Hargus creek in the city, or Darby creek, two miles distant; ten miles of mains varying in size from 4 to 16-in. internal diameter in which shall be located 100 hydrants.

The bids were as follows: Moffett, Hogdkins & Clark, Watertown, N. Y., (stand pipe) Hargus creek, $4,200 annually; Darby creek, $4,700 annually.

H. N. P. Dole, Columbus, Ohio, (direct pressure) Hargus creek, $4,200 annually; (stand pipe) Hargus creek, $5,000 annually.

Holly Manufacturing Company, Lockport, N. Y., (direct pressure) Hargus creek, $5,250 annually; Darby creek, $6,000 annually.

J. P. Martin & Co., Xenia, O., (stand pipe) 200 hydrants, $80.00; 100 hydrants, $47.50.

American Water-Works and Guarantee Co., (stand pipe) Hargus creek, $3.600 annually; Darby creek, $4,400 annually.

Samuel R. Bullock & Co., New York, Hargus or Darby creek, $3,500, or 12 miles of mains 130 hydrants for $4,030 annually.

This is said to be the lowest hydrant rental in the State of Ohio offered this year.

NEWS OF THE WEEK.

Railroads, Bridges and Canals.

Storm King Bridge.—The officials of the organization are James W. Husted, of Peekskill, and Charles Swan, John Linley, William Libbey and Amos Tenney of New York. The Phœnix Bridge Co. has the contract for construction.

Nicaragua Canal.—The incorporators of the Maritime Canal Company are Frederick Billings, Charles P. Daly, H. L. Hotchkiss, Francis A. Stout, Daniel Ammen, William L. Merry, Homer Davis, Edward F. Beale, James H. McMullin and Shepard Homans. The principal office is to be in New York City. Capital to be not less than $50,000,000 nor more than $100,000,000.

Trans-Andean Railroad.—Work on the Trans-Andean Railway, which has long been in progress in the Argentine Republic, is about to be commenced on the Chilian end, and the line to connect the Atlantic and Pacific across the central portion of South America is expected to be completed within two years. It will be some 800 miles long, from Rosario, on the great navigable river Parana (about 175 miles northwest of Buenos Ayres), westward to Valparaiso, the great seaport of Chili. Of this, all but 140 miles are completed, but this gap covers the Andes mountains and involves very heavy and expensive work. An important branch of the Andine Railway from Mendoza northward to San Juan, about 100 miles, was completed and opened in May.

Railroading in Mexico.—The expenses of railroading in this hot climate are great. Wooden ties have but a short life, cracking in the dry season and rotting during the rainy months; bridge timber and piles also wear out rapidly. Freight cars must be painted frequently to prevent drying and cracking, and even the substantial Pullman cars shrivel under this exposure. Fuel constitutes a large item of outlay. Mesquit roots are burned on the Central road; pine cut along its route is used on the Interoceanic, and the Vera Cruz Company feed their engines coal blocks that are brought from Wales as ballast. The decay of ties will in time necessitate a serious outlay on the Central road, for wooden sleepers cost here $1 each. It is evident that iron ties are a necessity in Mexico, and they are just coming into use. The climate tends to preserve the rails and iron bridges—provided the latter escape the torrents of the rainy season. Engineers command better wages here than they do in the United States, for only that inducement brings them here. The general staffs of the roads are also well paid, but the section hands, who are peons, work for small wages. The natural and proper tendency on all the roads is to employ Mexicans when the right men can be obtained. This policy helps to protect the property of outside corporations doing business here.—Springfield, Mass., *Republican*.

Wear of Steel Rails.—The *Revue Générale des Chemins de Fer* recently printed a paper by M. Conard on the wear of steel rails. His observations have resulted in the following conclusions:—(1) that the wear is caused by the number of trains, more than by the tonnage, which passes over them; (2) that it is proportioned to the extent to which they can deflect when the wheels pass, and is therefore proportional, under similar circumstances, to the spacing of the cross-ties; (3) that with similar conditions of track and traffic, the higher the percentage of carbon, and of manganese also apparently, the better will the rail wear; (4) that with an increase of hardness in the steel, and a greater rigidity under traffic, the wear diminishes correspondingly. The average composition of rails manufactured at the five large German works of Hörde, Krupp, Phœnix, Witkowitz and Reschitza was as follows: carbon, 0.31; manganese, 0.33; silicium, 0.08; phosphorus, 0.09; sulphur, 0.01, and copper, 0.14; the composition of rails from the Paris, Lyons & Mediterranean R. R., which have shown a better wear than the above, averaged as follows: carbon, 0.83; manganese, 0.69; silicium, 0.15; phosphorus, nearly 0.05, and sulphur, 0.05. Although on German railroads the rolling stock is lighter and the speed of the trains slower than on French railroads, yet with equivalent conditions of track the difference in the wear of the rails was found to be as 1 to 1.5 in favor of those manufactured in France. Other figures are given which show that on iron ties the wear is found to be greater than on those of wood. He states that in every case where the weight of the car loads, and the speed of the trains is to be increased, the track must be laid with heavier rails, and the roadbed must be improved so as to render the track able to safely and economically carry the traffic under the new conditions.

Contracting.

Sewers.—The Holyoke, Mass., committee on sewers and drains have awarded the contract for furnishing the city with cement pipe this season, to Samuel Snell & Co., at these figures: 24-inch, 97 cents; 18-inch, 56 cents; 15 inch, 37 cents; 12-inch, 28 cents, 10-inch, 23 cents; 8-inch, 15 cents. The other bid was made by S. T. Lyman & Son, and their prices were from one to four cents higher than Snell & Co.'s. 4,000 feet of the pipe will be needed.

Paving.—The Street Committee, Newark, N. J., has opened the bids for the repaving of Broad street, from William street to Clinton avenue, with oblong granite blocks. The firm of Messrs. B. M. & J. F. Shanley had the lowest bid and was awarded the contract. The bid was thirty-nine cents per foot for bridge-stone for crossings and $2.43¼ per square yard for paving. The other bidders were Keogh & Conway, who bid forty-nine cents for bridge stone and $4.47 for paving, and Thomas O'Connor, forty-five cents for bridge-stone and $2.49 for paving.

Culverts.—Bids have been opened for culverts at Manchester, N. H., as follows: Frank S. Bodwell, both culverts, $1775; L. A. Verville & Co., Spruce street culvert, walls for the culvert, $2.65 per perch; covering $2.75 per perch; rubbling $2 per perch; digging for foundations, $10; William G. Laundry, Spruce street culvert, $425; Beech street, $675; Warren Harvey, Spruce street, $2.37 1-2 per perch; Beech street, $2.73 per perch or $425 for Spruce street, $665.62 for Beech street, with 3 per cent. discount if awarded both contracts. Mr Harvey was awarded both contracts.

Cable Engines.—Contracts have been awarded for the two new engines of 600 horse power each, that are to drive the cable on the East river bridge. The present engines are only 250 horse power, and the additional power is needed to meet the demands of traffic. The flowing bids for the engines were received:

William Wright, Newburg, N. Y.	$14,910.00
Dickson Manufacturing Co., Scranton, Pa.	18,150.00
Phenix Iron Company, Trenton, N. J.	17,350.00
Hewes & Phillips Iron Works, Newark, N. J.	17,500.00
Southwark Foundry and Machine Company, Philadelphia, Pa.	18,150.00
Buckeye Engine Company, Salem, O.	19,000.00
Fishkill Landing Machine Company, Fishkill on the Hudson, N. Y.	21,300.00

For the remainder of the plant, including cable drums, sheave pulleys, etc., the bids were:

Southwark Foundry and Machine Company, Philadelphia, Pa.	$17,836.25
Phœnix Iron Company, Trenton, N. J.	26,390 00
Poole & Hunt, Baltimore, Md.	27,815.00
Dickson Manufacturing Co., Scranton, Pa.	28,110.00

In each instance the lowest bid was accepted, the awards being made to William Wright for engines, and the Southwark Foundry for the cable plant.

Brooklyn & Brighton Elevated Railway or Bridge.—The commissioners of Cuyahoga county, Ohio, will receive proposals until July 29th, for furnishing the labor and materials required for the construction of an elevated roadway or bridge, beginning at a point in Brooklyn village, and extending across Big Creek valley in a southerly direction to a point in the village of Brighton, according to the plans and specifications prepared by Walter P. Rice, civil engineer, for the County Commissioners of Cuyahoga county, Ohio. Each proposal must be made separately on the following items of substructure and of wood and iron superstructure, viz.: 1.—Substructure, including masonry, foundations, excavation, grading, piling, embankments, timber foundations, protections, structures and drains. 2.—Wood superstructure, including 660 lineal feet, more or less, of timber trestle work, roadway, and railings; bids to be made per lineal foot. 3.—Iron superstructure, including 13 60-feet spans, more or less, and 12 30-feet spans, more or less, supported on braced iron bents as per drawings. The bids on the same to be divided as follows: (a) Bids for 30-feet and 60-feet spans to be made per lineal foot, including the trusses and floor systems complete. (b) Bids for railings to be made per lineal foot of bridge. (c) Bids for braced iron bents to be made per lineal foot vertical, measured from top of masonry to top of bents. Plans and specifications may be seen and blank proposals may be obtained at the Auditor's office, on and after Monday, July 19, 1886.

Bridges.—The following proposals have been received by the Commissioners of Lancaster county, Pa.:

For Bridge over Mill creek at Ressler's Mill—Iron Superstructure: Groton Iron Bridge Company, $1,146; Jno. Denithorne & Son, $942.60; Dean & Westbrook $1,123; Pittsburg Bridge Company, $14.82 per foot; Columbia Bridge Company, $14.20 per foot. Wooden Superstructure: Thomas D. Grover, $1,400. Iron Superstructure and Masonry: E. McMellen, plan A, $1,573; plan B, $1,697. Wooden Superstructure and Masonry: E. McMellen, $1,747; Jacob Kauffman & Co., $1,530. Masonry: John R. Smith, $2.87 per perch; riprapping, $1.80; John Kreckel and Joseph Licht, $650; Joseph Licht, $750. Abutments for iron bridge; Jacob Kauffman & Co., $365.

Leinbach's Mill over Cocalico creek, near Reamstown—Iron Superstructure: Groton Iron Bridge Company, $874; John Denithorne & Son, $819.90; Dean & Westbrook, $980; Pittsburg Bridge Company, $14.98 per foot. Wooden Superstructure: Thos. D. Grover, $1,266; S. Stauffer, $800. Iron Superstructure and Masonry: E. McMellen, plan A, $1,447; plan B, $1,547. Wooden Superstructure and Masonry: Jacob Kauffman & Co., $1,475; E. McMellen, $1,597. Masonry for Iron Bridge Abutments: Jacob Kauffman & Co., $394.

Wood's Mill over Conowingo, Fulton twp.—Iron Superstructure: Groton Iron Bridge Company, $1,297; John Denithorne & Son, $1,377.94; Dean & Westbrook, $1,421; Pittsburg Bridge Company, plan No. 1, $15.23 per foot; plan No. 2, $16.23 per foot; Columbia Bridge Company, $14.80 per foot. Wooden superstructure: Thos. D. Grover, $1,754; Samuel Stauffer, $1,089. Iron superstructure and masonry: E. McMellen, plan A, $2,647; plan B, $2,820. Wooden Superstructure and Masonry: E. McMellen, $2,967; Jacob Kauffman & Co., $2,193. Masonry: McDowell & Nesbitt, $6.75 per perch; William Richards & John Riley (for iron and wooden), $6 per perch; Joseph Licht, $3 per perch; Jos. Licht (coping complete), $150. Abutments for Iron Bridge: Jacob Kauffman & Co., $860.

The three bridges—iron superstructure: John Denithorne & Son, $3,075; masonry, John Denithorne & Son, $3 per perch; riprapping, $2.

The Columbia Bridge Company, if awarded two or more bridges, will deduct fifty cents per foot.

Contractor vs. City.—Mayor Grinsell, of Eau Claire, Wis., has directed the City Treasurer to pay out no money to the contractors who have been given by a special committee the work of constructing a mile of sewers, the contract price being about $8,000. Hitherto the provision of the charter requiring the Mayor's signature to orders on the City Treasurer for payment of bills has been in a state of desuetude. The Mayor now proposes to revive its force, and he will decline to sign warrants for payment for work on sewer construction on the ground that he believes the taxpayers do not want sewers built this year. The fact that the work is under the control of a special committee, created, under a special ordinance, by the old council before the present administration could get a chance at it, is believed to have much to do with the Mayor's opposition, which, however, is given color by the fact that residents of a portion of the city have petitioned against sewers. In the meantime the special committee has had the work begun, but it looks as though the contractors would be obliged to sue in order to get their money, as the City Treasurer will follow the Mayor's instructions. * * * The sewerage business has assumed a new phase, and Fox & Huyssen, who took the job for $7,600, have put a crew of men to work, despite Mayor Grinsell refusing to subscribe his name to the contract. The action of the sewerage committee is ratified by a majority of the aldermen, who urged the contractors to proceed with the work despite the protestations of those opposed to the measure, assuring them of their compensation.—St. Paul, Minn., *Globe*.

Bridge.—The Commissioners of Muskingum county, Ohio, have received the following bids for the construction of the proposed bridge across the Muskingum river at Gaysport:

SUBSTRUCTURE.

T. B. Townsend, Zanesville, stone work, per perch	$ 5.50
Excavation, dry, per yard	.50
Piling, per foot	.40
R. Meredith & Son, Marietta, stone work per per h	5 40
Piling, per lineal foot	.40
Lumber, per 1,000 feet	25.00
Wet excavation, per yard	1.00
Dry excavation, per yard	.25
Iron, per pound	.04
J. C. & S. B. Miller, Nashport, stone work, per perch	5.47
Iron, and ice breakers	100 00
Piling, per pile	3.00

SUPERSTRUCTURE.

Shiffler Beidge Works, Pittsburg	$20,396.30
With draw	26,564.10
Morse Bridge Company, Youngstown	15,050.90
With draw	18,539.70
Lomas Bridge Works, Cincinnati	14,661.50
With draw	18 371.50
Mt. Vernon Bridge Company	14,012.50
With draw	17,645.50
Canton Bridge Company	15,500.00
Milwaukee Bridge Company	15,163.00
With iron hand rail	15,829.70
Penn Bridge Company, Beaver Falls	14,480.00
Massillon Bridge Company	15,312.00
Columbia Bridge Company	21,447 00
King Bridge Company, with steel joist, two sidewalks	15,086.30
With steel joist, one sidewalk	14,868.10
With wood joist, two sidewalks	12,920.70
With wood joist, one sidewalk	12,675.20
Smith Bridge Company, Toledo, plan No. 1, sub and superstructure	34,500.00
Plan No. 2, sub and superstructure	30,850.00
Plan No. 3, sub and superstructure	28,300.00
Plan No. 4, sub and superstructure	30,800.00
Plan No. 5, superstructure, iron	16,756.00
Plan No. 6, superstructure, iron	13,275.00
Plan No. 7, superstructure, wood	10,325.00
Plan No. 8, sub and superstructure	24,800.00

Asian Railroad Progress.—A correspondent writing from Askabad to the *Russki Viedomost* (Russian Gazette) says: "The construction of the Trans-Caspian Railway is progressing rapidly toward completion. The embankment is nearly ready all the way to Merv, and the rails are already laid down to Kaakhee, a point about 30 versts distant from the future station of Dooshek, so that everything is ready for opening 560 versts of line. The carriage of material and the means for its transport are both on an extensive scale, and it is hoped that circulation will be possible up to Merv from the 1st of June. At the present moment great activity is being shown in the construction of the bridge over the river Tendghen, which work has been partially delayed through the peculiarly unfavorable nature of the ground forming the bed of the river, in consequence of which it has been necessary to sink into it five rows of cast-iron piles, each pile being 63 feet in

length. At Askabad itself, the future center of the Trans-Caspian railway system, the buildings in connection with the railway are rapidly rising. They are all very elegant structures, and the station itself will be after a design by the Academician Uriaub, and not unworthy of any town in European Russia."—London (Eng.) *Times*.

Sewer.—At Montreal, proposals have been opened as follows for the construction of the proposed upper level intercepting main drain, estimated to cost $110,000:

	N. Laporte.	R. McKeown.	J. Murray.	F. McKenna.
Sec. A, 7 ft. diam.	$52·55	$43·00	$79·80	.....
Sec. A, 5 ft. diam.	30·50	37·00	69·80	.....
Sec. B, 5 ft. diam.	37·90	33·00	.....	.....
Sec. C, 5 ft. diam.	34·95	29·00	.....	.....
Sec. D, 5 ft. diam.	.....	29·00	.....	20·00
Sec. D, 4 ft. diam.	21·75	19·00	.....	14·75
Rock excavation	4·00	4·00	.....	4·00
Seven ft. diam.	.....	41·00	.....	.....
Five ft. diam.	.....	31·00	.....	.....
Four ft. diam.	.....	18·00	.....	.....
Rock excavation	.....	4·00	.....	.....

The City Surveyor stated that according to Mr. McKeown's tender which covered the whole work, $164,000 would be needed and it was resolved that report be made to Council asking an additional appropriation of $65,000 to enable the Committee to accept the contract of Mr. McKeown for the whole work, and that in the meantime the deposits made by the other tenderers be returned to them.

Money in Croton Water.

The city received for Croton water rents for the week ending July 3rd, $77,576.13.

Henry Villard Coming Back.

From the Minneapolis Tribune.

WASHINGTON, June 29.—A private letter received here to-day from Berlin states that Mr. Henry Villard will return to this country about the middle of August, and will take up his residence in his castle in New York. It is stated that the trouble in the Oregon Transcontinental Company between Elijah Smith, President, and his faction, and Drexel, Morgan & Co., bankers, is liable to culminate in the election of Villard to the Presidency of this company. Drexel, Morgan & Co., who are his friends, it is said, control the majority of stock, and at the next election will depose President Smith and put Mr. Villard at the head of the company once more.

Advance in the Price of Tubing.

An important meeting of tube manufacturers was held at the Fifth Avenue Hotel, this city, June 19th. Representatives were present from each of the fourteen tube works located in different parts of the country, five of which are in Pittsburg. It was decided to make a considerable advance in the selling price of certain classes of tubing. The largest advance is 15 per cent. on 5½ casing, and on the standard gauge the price is raised from 40 cents per foot to 45 cents; on all other sizes 5½% per cent. will be thrown off instead of 55 per cent., there being twenty-five sizes of castings. On 4-inch line pipe the price is increased from 32 cents to 34 cents; on 5-inch from 46 to 48 cents, and on 6-inch from $1 to $1.10. The price of tubing 2 inches in diameter is raised from 13 cents to 14 cents, an advance of 7½ per cent. on this line of goods.

Draining a Big Lake in Greece.

From the London Standard.

ATHENS, June 13.—The opening of the canal, which has been in process of excavation for the past five years for the purpose of draining Lake Copais, was celebrated yesterday by a brilliant inaugural ceremony, in the presence of the French Minister and numerous distinguished persons from Athens.

Lake Copais, which is situated near Thebes, in Bœtia, covers an area of over sixty thousand acres, or nearly a hundred square miles. The French company which has been engaged in carrying ing out the enterprise, is now so far advanced with its work that two-thirds of the waters of the lake are expected to be drawn off within the next two or three months. Hitherto this inland sea has been chiefly remarkable for the malaria and fevers regularly prevailing on its shores during the hot season. By its drainage not only will this evil be permanently removed, but Greece will add to her territory many thousands of acres of arable soil of the greatest fertility. The lake is fed by the rivers coming down from Mount Parnassus, whose waters are hereafter to be employed, by help of a new system of canals, in irrigating the surrounding country.

The party visited the works at Anthedon, the outlet to the sea, where the Count de Moüy landed under a salute from the French frigate Venus, which was accompanied by the gunboat Capricorn.

M. Scouloudis, the principal promoter of the undertaking, has received a telegram from M. Tricoupis, the Premier, congratulating him on the inauguration of a national enterprise of immense utility to the country.

Foreign News.

From Herapath's Journal

We understand that the question of the Suram tunnel on the Trans-Caucasian Railway has been definitely settled by Russia On the 5th of June the Council of the Empire decided in favor of opening a credit of a million roubles for the commencement of the works. 700 000 roubles will be placed at the disposal of the State department specially charged with the piercing of the tunnel, which is to be four versts in length, plus thirteen versts of a new line turning the pass of Suram. The Trans-Caucasian Railway Company is to receive 300 000 roubles for the works of the remaining length of this new line. The whole of the works will cost, according to the estimates, more than 10,500,000 roubles, of which upwards of 7,000,000 roubles will be absorbed in cutting the tunnel, which will be, in respect of length, the most arduous operation of this kind that has been executed on any Russian railways, the tunnel on the Vladikavkas line being only 600 sagnes (1,400 yards.) The funds required for the works will be raised by an issue of new shares by the railway company bearing a Government guarantee.

WE learn that the construction of the Scinde-Hagar strategical frontier railway is making rapid progress. A section ninety miles long has been laid from Shen Shah, opposite Mooltan, on an alignment parallel with the left bank of the Indus. The rails are being laid at the rate of three miles daily. The Scinde-Pishin Railway will, it is said, owing to financial pressure, not be carried for the present past Shah Ahmed, the site of the proposed intrenched camp, but an iron bridge will be thrown across the Lora river in front of that position. It is possible that the delay may prove beneficial if it has the result of procuring a more thorough examination than has yet been made into the respective merits of the tunnel scheme, and of the Khojah alternative route by Mushki, which, although longer, would avoid the difficulties of the Khojah range.

THE Manchester Ship Canal Bill is now fairly out of the wood. The Select Committee of the House of Lords, presided over by the Earl of Milltown, on Saturday afternoon passed the Bill authorizing the Company to pay interest out of capital at the rate of 4 per cent. during the construction of the canal, the aggregate amount so paid not to exceed £752 000. We learn that the contract for the construction of the works only has been taken by the eminent firm of Messrs. Lucas and Aird for the sum of £5,750,000.

THERE is good news to hand for the Varna proprietors. In the newly assembled Bulgarian Parliament, as it may be called, a loan of four millions sterling will be proposed for the purchase of the Varna Railway, the construction of a railway from Bourgas to Yamboli, and the payment of the expenses of the war. We have no doubt the matter will culminate satisfactorily, although delays may intervene.

WE are authorized to state that a telegram has been received from the General Manager of the Brazil Great Western Railway at Pernambuco, stating that the commencement of the works of the Timbauba extension was inaugurated on the 18th inst.

Market Report of Engineering Materials.

New York July 8, 1886.

IRON.

STRUCTURAL IRON.		
Angles	2.00c	@ 2.10c
" steel	2.35	@ 2.45
Tees	2.40	@ 2.45
Beams and channels, American	3.0	@
Tank plates	2.10	@ 2.20
Shell plates	2.4	@ 2.5
Steel plates, Tank	2.70	@ 2.75
WROUGHT-IRON PIPE. PITTSBURG.		
Butt welded, black ..... Discount		45
" galvanized ..... "		35
Lap welded, black ..... "		60
" galvanized ..... "		42½
Boiler tubes		52½
RAILS.		
Steel (large lots at mill)	$34.00	@ $35.00
Old rails	18.50	@ 19.00
Old rails, steel	22.00	@ 23.00
R R. spikes		2.40c
R R. splice-plates	1.80	@ 2.00
R R. track bolts, square nuts	3.00	
Barb-wire fencing, galvanized	4.38	
" " painted		4.00
Corrugated iron		
Nails		
Iron, per keg	2.00	@ 2.05
Steel do.	2.55	@ 2.60

METALS.

COPPER.		
Lake Superior	9.75	@ 9.86
Other Brands	9.50	@ 9.70
LEAD.		
Com. Domestic		4.90
Lead Pipe	.06¼c.	
Tin-Lined Lead Pipe	.15	
Sheet Lead	.07¼	
ZINC.		
Sheet	$4.60	@ 4.75

BRICK.

Cargoes (afloat)		
Choice Brands	7.25	
Haverstraw ..... per M.	6.50	@ 7.00
Fishkill	7.00	
Up-River	6.00	@ 6.50
Jerseys	5.50	@ 6.00
Long Island	6.50	@ 6.75
Pale	4.50	@ 4.75
FRONTS.		
Croton, red	11.00	@ 15.00
" dark	11.00	@ 15.00
" brown	10.00	@ 14.00
Philadelphia pressed	24.00	@ 28.00
Trenton "	24.00	@ 26.00
Baltimore "	37.00	@ 41.00
Buff "	33.00	@ 35.00
Enameled English	85.00	@ 130.00
" American	80.00	@ 120.00
Fire brick	25 00	@ 55.00
" American, No. 1	30.00	@ 35.00
" " No. 2	25.00	@ 30.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

CALVIN TOMKINS:		
"Old Newark Co's." Cement		$1.10
BAETJER & MAYERSTEIN:		
Hanover Portland	$2.60	@ $2.65
BELLONI & Co.:		
Hemmoor "Crown" brand		2.50
JAMES BRAND:		
K. B. & S.	2.55	@ 3.00
BROOKS, SHOOBRIDGE & Co.	2.45	@ 2.60
HOWARD FLEMING:		
Gibbs' English Portland, 400 lbs.	2.50	@ 2.75
K. B. & S. "	2.25	@ 2.50
Stettiner, German	2.65	@ 2.85
Lagerdorfer, "	2.45	@ 2.75
Fleve, A 1, Belgian	2.35	@ 2.50
Roman	2.75	@ 3.00
Keene's Coarse	4.75	@ 5.50
" Fine	7.75	@ 8.50
" Superfine	8.50	@ 10.00
FISHER, ERSKINE W.:		
Stettin (German) Portland Cement	$2.40	@ 2.75
GABRIEL & SCHALL:		
Vorwohler "Lion"	2.65	@ 3.10
HUDSON RIVER CEMENT Co. Rosendale		0
JOHNSON & WILSON:		
Saylor's American Portland	2.15	@ 2.45
LESLEY & TRINKLE, Philadelphia, Pa.:		
"Giant" Portland	2.20	@ 2.40
Improved "Union"	1.25	@ 1.50
Union	1.10	@ 1.20
MARCIAL & Co.:		
J. B. White & Bros. Coarse Keene's	4.25	@ 4.50
" Superfine	7.25	@ 7.50
" Portland	2.45	@ 2.85
NEW YORK CEMENT Co.:		
Rosendale		1.10
N. Y. & ROSENDALE CEMENT Co.:		
Rosendale, "Bridge" brand		1.10
SINCLAIR & BABSON:		
Alsen's Portland Cement Works	2.35	@ 2.85
K. B. & S.	2.25	@ 2.50
STANDARD CEMENT Co		
E. THIELE:		
Dyckerhoff	2.90	@ 3.25
UNITED STATES CEMENT Co.:		
English Portland	2.25	@ 2.40
German "	2.00	@ 2.15
Standard	1.50	@ 1.65
Windsor and Improved Rosendale	1.00	@ 1.10
UNION AKRON CEMENT Co.:		
Akron "Star" brand	1.00	@ 1.10

ASPHALT.

ROCK.		
Prices range per ton	$15.00	@ 20.00
According to quantity or brand, and whether taken from vessel or store.		
PAVEMENT.		
Barber's Asphalt	$2.50	@ $3.

LIME.

Rocklock Cement Co.'s Ground	.80
Rockland, common per bbl	1.00
" finishing	1.20
State, common	.85
" finishing	1.10
Kingston, ground	.90
Add 25c. to above figures for yard rates.	

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.95	@ 1.00
" " No. 2 "	0.75	@ 0.85
" " light drab "	0.80	@ 0.95
Berlin " in rough "	0.75	@ 1.00
Berea " " "		
Brown stone, Portland, Ct. "	1.00	@ 1.35
" Belleville, N. J.	0.75	@ 1.35
Granite, rough	0.45	@ 1.25
Common building stone per load	2.00	@ 3.00
Base stone, from 2¼ to 6 ft. lengths, per lin. ft.	0.40	@ 3.00
Concrete and macadam stone, Tomkins Cove, per cub. yd		$1.65

SLATE.

Purple roofing per square	6.00	@ 7.00
Green "	6.00	@ 7.00
Red "	15.00	
Black Penna. (at New York) "	4.50	@ 5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00	@ 20.00
" Choice "	65.00	@ 70.00
Tally plank, 1¼ in. 10 in. dres'd, each.	.44	@ .50
Tally boards, dressed com. "	.28	@ .30
SPRUCE, Boards dressed "	.25	@ .28
Plank, 1¼ in "	.28	@ .30
" 2 in. "	.38	@ .40
" 2 in. dressed "	.43	@ .45
Timber per M.	13.00	@ 16.00
HEMLOCK, Boards each.	.18	@ .20
Joist, 2¼ × 4 to 4 × 6 in	.16	@ .44
OAK per M.	55.00	@ 65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00	@ 40.00
YELLOW PINE, Girders "	25.00	@ 30.00
Dressed flooring "	28.00	@ 35.00
SHINGLES, Extra shaved pine, 16in. "		
" sawed 18 in. "	5.75	@ 6.00
LATH, Cargo rate "	2.00	@ 2.10

PAINT.

Lead, white, American dry per lb	.04¾	@ .06¼
" " in oil pure "	.07	@ .07½
" English, B. B. in oil	.08¼	@ .08¾
" Red, American		.06¾
Litharge "	.05½	@ .06
Venetian red, American "	.01	@ .01¼
Indian red "	.08	@ .10
Vermillion, American lead "	.10½	@ .11½
Paris green "	.15	@ .18
Umber, Amer. raw and powdered per lb.	.01¼	@ .01¾
Drop black, Amer.	.07	@ .13
" " Eng.	.11	@ .13
Chrome green	.10	@ .25
Oxide zinc, American	.03¾	@ .03¾
" French	.05¾	@ .07½